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NOTES AND COMMENTS.

The New London University.

BY the time this is in the hands of our readers the fate of the new Government will be practically decided. We hope, whichever party come into power, that time will be found to set going a real university for London. The delay in the matter is already preposterous. After long and arduous conflicts a reasonable scheme has been prepared, and is contained in the report of the "Gresham Commissioners." All the institutions concerned have approved the scheme; the majority of educated opinion regards it as a reasonable and practicable scheme. It contains enough compromise to satisfy even the most timid about the rights of minorities, and it must come into operation.

Here is our great London, the home of the chief scientific societies in Great Britain, containing a population that would provide innumerable students, the centre of the wealth and of the intellect of the country, provided only with some dozen inchoate institutions full of activity that is wasted because of senseless rivalry and complete want of co-operation. Here is a scheme waiting that shall breathe into them some corporate life: a scheme that has become possible only by many generous and long-sighted concessions on the part of bodies that have been building themselves up with much self-sacrifice and vast unrecognised expenditure of energy. Factious opposition and the exigencies of party conflict must now be overborne by strong and swift action. There lies to the hand of the successful political party a clamant opportunity, the embracing of which will be applauded on all hands.

Culture and Biology.

One hears it said everywhere that Huxley was an example of the cultured man of science, and that such an instance is conspicuous by its rarity. Similarly it is frequently asserted that he was a man naturally inclined to letters and culture, who had become a man of science by the accident of events. We believe this to be a mis-

apprehension. We do not dispute that Huxley was a man of unusual and commanding ability, who, in whatsoever environment he had chanced to live, would have been conspicuous among his fellows. But a considerable part of his culture arose from a necessary consequence of his scientific pursuits. Most scientific men, like most educated people, have an acquaintance with Latin and Greek. But it is also necessary that they should make themselves familiar with French and German. There are very few who do not in addition acquire a working knowledge of Italian: a large number can read Russian and a Scandinavian language in addition. We venture to think that among the educated classes generally, among parsons, journalists, lawyers, bankers, and even men of letters, there are very few possessed of this ordinary equipment of scientific men. Although the languages are acquired as a professional necessity, often as a distasteful task, there are few who confine their reading to foreign scientific memoirs. Speaking of our own acquaintances among men living in London occupied in one branch of science, we know one who has amused himself by translating into English verse German and Norwegian poetry; another Russian and French; another who is an authority upon Spanish dramatic literature; yet another whose daily companion is Machiavelli. And if it came to a contest in Continental light literature, we could make up a scientific eleven in whom we should have every confidence.

HUXLEY AND AGNOSTICISM.

To a large section of the public, Huxley was most conspicuous as what it thought a militant scientific infidel, who had invented for himself the euphemistic appellation "agnostic." We cannot enter into religious controversy here; but one or two things may be worth pointing out. Huxley's religious views had no direct connection with his acceptance of Darwinism. He himself states that before 1859 he had abandoned belief in the Christian traditions; and he also insisted that there was no logical difficulty in the "reconciliation" of Christian theology with an evolutionary view of creation. With so rigid a theologian as the late Canon Aubrey Moore and with Paley himself, he held that the argument from design lost nothing of its logical force, although the organic world had come into existence slowly as a result of variation, inheritance, and selection. It was only the literal acceptance of Genesis as an inspired account of actual events that was overthrown by evolution.

Huxley's agnosticism was the lineal descendant of Descartes' philosophy. Descartes in 1619, as Huxley recalls in his preface to "Hume," made the famous resolution to "take nothing for truth without clear knowledge that it is such." This was Huxley's attitude to religious dogma, as indeed to every other dogma, scientific, political, or philosophical. It led him to decide against

the authenticity of the Christian revelation. It led him to an absolutely open view as to the existence of the Deity. But these opinions, important as the opinions of any able man on any serious subject which he has considered seriously may be, are the individual opinions of Huxley; they are not the formulated and inevitable view of science. Philosophically, Huxley was not a materialist, even in the limited popular sense in which Tyndall was a materialist. He was a pure idealist in the sense of Berkeley.

Sunday Opening.

It is to be hoped that the Select Committee of the House of Lords, which is now inquiring into the working of the Lord's Day Act of 1781, will lead to some much needed amendments in the law. We, as scientific people, are chiefly concerned with the Sunday opening of Museums. We are glad to learn, from the evidence of Mr. Shaw Maxwell, chairman of the Glasgow Sunday Society, that public opinion, even in that city, is now in favour of the movement, although some time ago the good citizens of Glasgow were greatly scandalised by Professor Blackie's getting on the platform to sing "Let us haste to Kelvin Grove," on the Sabbath. Meanwhile the various Sunday societies are taking the opportunity to display more than usual energy. They held a congress at Prince's Hall, London, on July 1, and passed the following resolutions: "That the Lord's Day Act should not apply to any society or other body established and maintained for the public advantage and not for pecuniary profit." "That all authorities of museums, art galleries, and other institutions open on Sundays should provide for at least one day's rest in seven for the whole of their servants." So far, indeed, as museums that are open free are concerned, we are not aware that they require any more legislation than do tobacconists and sweet-shops; all that they need is the support of public opinion, which will no doubt become more healthy under the double influence of such meetings as these and the attacks of the Lord's Day Society. But example is better than precept, and if the new Government can succeed in opening the British Museum and the South Kensington Museum on Sundays, as has before been attempted, then other museums are likely to follow suit. Till then, the great public of week-day workers must be grateful to such enlightened private individuals as Mr. Horniman, whose museum at Forest Hill was visited on Sunday, June 2, by 2,976 persons. We may recall here the facts that Professor Huxley gave the first lecture for the Sunday Evenings for the People in 1866, and was President of the Sunday Lecture Society. This year's President of the Sunday Society is Canon Barnett, whose long experience of the true needs of the people in the east of London, lent peculiar weight to his eloquent address in favour of the Sunday opening of something other than public-houses.

SEXUAL CHARACTERS IN NAUTILUS.

THIS question seems to be settled at last. Just a month after our publication of Mr. Willey's important paper, with its illustrations of the differences between the shells of the male and female *Nautilus pompilius*, there appeared in the *Comptes rendus* of the French Academy (vol. cxx., p. 1,431) a note by Dr. A. Vayssière, of Marseilles, "Sur le dimorphisme sexuel des Nautiles," which confirms and extends the observations of Willey. In both *N. pompilius* and *N. macromphalus* the opening of the female shell tends to be laterally compressed, while that of the male shell tends to be wide, especially towards the inner side of the whorl. The shell of the female has also a slight tendency to be keeled, and its margin is more sinuous than in the male, which is the opposite of Van der Hoeven's statement. The difference of width is clearly due to the size of the spadix, or copulatory arm of the male, which is on the right of the buccal bulb, and thrusts the bulb a little to the left; thus this portion of the body becomes nearly as wide as that at the level of the eyes. In an adult male the width of the hood equals its length, so that it is two centimetres wider than in the female; its lateral margins almost entirely hide the eyes and tentacles in the male, but in the female the eyes and first two pair of tentacles are exposed. Dr. Vayssière states that the mantle is not shorter in the male than in the female, and supposes that Van der Hoeven said it was. We have been unable to find any such statement in Van der Hoeven's paper; what he referred to was the hood, as correctly quoted by Buckman and Bather in our own pages (vol. iv., p. 431), and he was merely saying the same as Vayssière, though in a different manner. Buckman and Bather, while admitting the existence of differences between shells of *Nautilus*, pointed out that the characters of width and of sinuosity in the margin increased with age; this is confirmed by Vayssière, who is, however, now able to show, with Willey, that these differences are actually sexual characters.

Applying these observations to the ammonites, Vayssière shows, as Buckman and Bather had already pointed out, that they are totally opposed to the views of A. d'Orbigny, P. Reynès, and H. Douvillé, and that they lend no support to the more complicated theories of Munier-Chalmas. Here, too, our English authors have received confirmation from Dr. J. F. Pompeckj in his study of Rhaetic ammonites (*Neues Jahrbuch für Mineralogie*, 1895, Bd. II., p. 42). His own observations "completely agree" with their conclusion that "the so-called males are in reality the final expressions of the various races to which they belong."

THE ORIGIN OF THE CEPHALOPODS.

IT was an interesting paper that Mr. J. Graham Kerr read before the Zoological Society on June 18. It emphasised the paired and

metameric character of the organs in *Nautilus*. Willey had already shown, in the paper referred to above, that the post-anal papilla represented the two posterior osphradia, or sensory organs at the base of the two hinder gills. Mr. Kerr suggested that the nerve-branches to this papilla represented the supra-anal commissure of the Amphineura. He supposed that the genital ducts of the female were homologous with the viscero-pericardial pores, so that there would be two pair of openings from the viscero-pericardial chamber to the exterior, just as there are two pair of renal openings. There is, however, nothing gained by homologising the viscero-pericardial pores with nephridia, for surely their position and opening into the nephridia in other molluscs is not so primitive as their direct opening to the exterior in *Nautilus*. It is recognised that the generative ducts are paired right and left, but that the left duct is rudimentary. It is therefore probable that, as Mr. Kerr suggested, the penis is a paired structure derived from the outer skin, with the left half rudimentary and having lost its connection with the duct.

It is generally held that the arms of the Cephalopoda are processes of the fore-part of the foot that have grown up round the head, and this view is based on the facts of development and on the circumstance that the arms receive their nerve-supply from the pedal ganglion or from a small ganglion connected therewith. Mr. Kerr apparently did not think any of the evidence worth discussing except that relating to the nerve-supply, and here he boldly denied that the pedal ganglion was the pedal ganglion, in other words, that it was homologous with the ganglia in the foot of gastropods. He believes that the ganglia of gastropods and cephalopods have been independently derived from a condition of continuous nerve-strands, such as occurs in *Chiton*. This is most probable, but it does not prevent the ganglion in question having been a pedal ganglion in the early days of its development. Mr. Kerr's conclusion is that "the Amphineura, and especially the Chitons, are of all living Mollusca those which most nearly approximate to the ancestral form of the time when the cephalopods diverged from the main molluscan stem." In the condition of the nephridia, however, *Nautilus* is even more metameric than *Chiton*, and it is surely possible that the various organs may have been affected by metamerism independently in those Cephalopoda that took to coiling their shells, while remaining simple in those whose shells remained straight and eventually became enveloped by the mantle. We look forward with considerable interest to the publication of the complete paper.

The Cultivated Cineraria.

It is a pretty quarrel, conducted with an agreeable virulence; and the beginning and the end leave us where we were. This was the fashion of it. Professor Weldon introduced a discussion on variation

at the Royal Society by giving an account of his investigations on variation in the shore-crab. To this discussion Mr. Thiselton-Dyer, in the fulness of his heart, brought down from Kew a modern cultivated cineraria and an example of the feral *Cineraria cruenta* recently brought from the Canaries by one of his assistants. It was an object-lesson of great beauty and interest, and the Director of the Royal Gardens pointed out the identity of the foliage and the striking dissimilarity of the blossoms in the two forms. Undoubtedly, as he stated, the cultivated form has come into existence by human selection, and so far "as is known it has been accomplished by the gradual accumulation of small variations." Thus, the Director at the Royal Society, and subsequently in a letter to *Nature*, so far as it is possible to judge from the evidence, brought forward the case of change as a simple contrast to the ordinary stability of plants in an unaltered environment.

But he was reckoning without his Bateson. Mr. Bateson has the belief, and has shown considerable ground for it, that slow variations and slow selection are not the chief factors in the modification of organic forms. We have repeatedly given reasons why we are unable to accept Mr. Bateson's alternative; but apart from the ultimate value of his theory, at least the expression of it had the result of bringing into prominence some defects of Mr. Thiselton-Dyer's position. Mr. Bateson roundly asserted that there was no ground for the inference that the cultivated cineraria had been produced by slow modification (*i.e.*, selection of small variations) of the feral *C. cruenta*. He was inclined to dispute even the identity of the foliage of the two, and he produced copious historical evidence tending to show that the cultivated form was a result of numerous artificial rearings of hybrids, and of sudden sportings subsequent to hybridising. Professor Weldon intervened with a pungent criticism of Mr. Bateson's interpretation of his authorities, bringing out the fact that little reliance could be placed on the evidence for the hybridising origin, and that evidence did exist as to the variation of *C. cruenta*, independently of, and before the existence of the so-called hybrids. Mr. Botting Hemsley wrote sorrowful words, which it is not unfair to paraphrase into some such as these:—"You know that, if I could, I would be on the side of anyone disputing Darwinism, but it is a sad truth that I don't believe in this hybrid origin business." Mr. Thiselton-Dyer accentuated the error of attaching importance to the use of the term "hybrid" by horticulturists. He established the fact that the foliage of the cultivated form is identical with that of *C. cruenta*, unlike that of other species, and that anatomical evidence shows affinities between the cultivated form and *C. cruenta*, but not between it and other species. Mr. Bateson, Professor Weldon, and Mr. Thiselton-Dyer, all returned again to the charge. Apparently Mr. Bateson remains of his original mind, but most who study the controversy carefully will conclude that there is no good evidence

for the hypothesis of hybrid origin; that there is good evidence for the origin of the cultivated form from *C. cruenta;* that Mr. Thiselton-Dyer was expressing a pious opinion rather than an elaborated judgment when he stated that "it had been accomplished by the gradual accumulation of small variations." We are inclined to share his belief; but we think that Mr. Bateson's polemic has been of service in that it has led to distinction between inference and known fact. We shall await with great interest the results of the work in progress at Kew on variation. It would be of inestimable advantage to science if we had the result of a series of experiments made under such competent guidance, on the relative possibilities of raising varieties from "sports," and by the selection of small variations. Perhaps the truth may lie between Mr. Bateson's theory of "sports" and the more orthodox view. Gradual selection may lead to the fixation of "forms of organic stability," which occasionally appear as "sports."

Fossil Plants of the Coal-Measures.

The last of a long series of papers in which the organisation of the Coal-Measure plants has been patiently worked out, and which forms one of the most valuable contributions to Palæontology issued by the Royal Society, is that on *Lyginodendron* and *Heterangium*. It is the joint production of the late Professor Williamson and Dr. Scott. The former, active to the last, has just left us, at a good old age; to the latter we look for a continuation of the researches to which the late Professor gave so strong an impulse. The paper deals with the vegetative structure of the two genera, which are described as among the most interesting and, at the same time, the most puzzling representatives of the Carboniferous flora. Nothing is certainly known of the reproductive organs, but their morphology and anatomy point to a position between ferns and cycads. The leaves of *Lyginodendron* are so like fern-leaves in form, venation, and minute structure, that they would, if our knowledge ended here, be referred at once to Filices. But the stem-structure suggests a cycad, the vascular bundles exactly resembling those in the leaves of existing Cycadeæ. One of the authors has, however, recently found that the peculiar mode of development of the bundles associated with the latter may extend to stem-structures, namely, in the genus *Stangeria*. The foliage of *Heterangium*, though less well preserved, is of the same type, while the primary structure of the stem recalls that of a fern like *Gleichenia;* the bundles continued from the leaves, on the contrary, closely resemble the foliar bundles of a cycad. In both genera secondary growth in thickness occurs, but, as the authors point out, this is no argument against a fern alliance, as the same happens in the modern genera, *Botrychium* and *Helminthostachys*. In conclusion it is suggested that they are derivatives of an ancient generalised race of ferns, from which they have already diverged considerably in the cycadean

direction. *Heterangium* seems the more ancient, and is certainly nearer the fern stock, while *Lyginodendron* "has advanced much further on cycadean lines," retaining at the same time conspicuous fern-like characters. "This view by no means involves the improbable assumption that these plants were the actual ancestors of existing Cycadeæ."

PLANT NOMENCLATURE AGAIN.

SEVENTY-FOUR botanists across the Atlantic have risen in revolt against the new American system of plant nomenclature to which we have already several times referred. In their manifesto they strongly urge postponement of any radical measures of reform which are based on purely theoretical grounds. It is easy enough to alter old and well-known plant names to suit this or that modern code of regulations, but impossible to set aside the old books which must always remain the historic basis of classification. What with the extremely diffuse literature, frequent insufficiency of description, and want of types or of authorised specimens, the poor systematist has enough to bear without the additional burden of remembering as many sets of names as there are codes of nomenclature; for about these matters there is no finality. There will always be the smooth-handed agitator who has a soul above or a capacity beneath honest work. Some of these gentlemen have lately been revising ordinal names on principles laid down by themselves. We are glad to note that the first suggestion in the circular in question is that "ordinal names, having been established by long usage, should not be subjected to revision upon theoretical grounds." The other rules provide for the retention of long-established and well-known generic names, and the use of the first correct combination in specific nomenclature, and refuse to allow the competition of varietal with specific names, and the retrospective use of the principle "once a synonym always a synonym." The length to which some folk will go is well exemplified in a recent number of *Erythea*, in which a writer takes exception to certain names proposed for some new species. Several are Latin and Greek hybrids, and one is a latinised form of a Mexican place-name. It is possible to imagine more euphonious combinations; but, apart from the mere name, were they the worst sounding conceivable, or constructed in violation of every rule of orthography, no one is justified in replacing them off-hand without examining the plants and ascertaining in the first place whether a new name be required. No botanist, with any self-respect, would thus become responsible for species in a critical genus.

A NOMINALIST!

THE following precious note appears on p. 498 of *The American Naturalist* for May, 1895:—

THE NAME OF THE SOUTHERN OR SPLENIC CATTLE-FEVER PARASITE.—The generic name given by Drs. Smith and Kilborne, having been previously used in Zoology, must be dropped. I propose the name *Piroplasma* to replace it.

PIROPLASMA BIGEMINUM (S. & K.)

Syn. *Pyrosoma bigeminum* Smith and Kilborne, Repts. Bn. An. Ind. '91-'92 (1893), p. 212, plts. IV-IX.—WM. HAMPTON PATTON, Hartford, Conn.

Mr. Wm. Hampton Patton is another of those that love to reap where they have not sown. The next time that a desire for fame leads him to irritate zoologists by the publication of a new name in this hugger-mugger fashion, we trust he will give the evidence on which the name due to the original author is stated to be pre-occupied, and that he will see more carefully to his own names. *Piroplasma* is either a solecism or a mongrel, but as its etymology is not given, we are unable to decide which.

BOTANY AND THE AMERICAN GOVERNMENT.

UNDER the title of "The Botanical Work of the Government," Mr. J. M. Coulter gives in the *Botanical Gazette* for June, a brief sketch of the work of the U.S. Department of Agriculture. There are four divisions. That of Botany, under Mr. F. V. Coville and seven assistants, includes, besides more purely scientific work, the investigations of weeds, of poisonous and medicinal plants, and the testing of seeds; 38,600 dols. was appropriated for its use in the past year. The division of Vegetable Physiology and Pathology, with Mr. B. T. Galloway as chief, finds work for as many as ten assistants. Potato disease, diseases of fruits and cereals, and the anatomy of galls, are among the subjects to which attention is now being given. The appropriation for the year ending June 30, 1895, was 26,100 dols. The division of Agrostology comes into existence with the first of July, as separate from the division of Botany. It deals with forage plants and grasses, its function being to instruct and familiarise the people with the habits and uses of these plants, to investigate their natural history and adaptability to different soils and climates, to introduce promising native and foreign kinds into cultivation, and to identify all grasses and forage plants which may be sent in for the purpose. Professor Lamson Scribner, its chief, is preparing a handbook of the United States grasses. He has two assistants, and the appropriation amounts to 15,000 dols. The Forestry division is under Mr. B. E. Fernow, with four assistants. Its main work during the past three years has been the study of the character and value of the woods of "merchantable species." Mr. Fernow has, however, a much more difficult task in hand, namely, the arousing and organising public sentiment in favour of a rational forest policy. Mr. Coulter's article brings home the fact that in some things our American cousins have got a long way ahead of us.

SCIENCE IN MEXICO.

WE have received *La Naturaleza*, the publication of the Mexican Society of Natural History, for 1893–95. This consists of five parts, being nos. 5–9 of vol. ii. of the second series, and gives one a good idea of the activity of naturalists in Mexico.

In zoology, Dr. A. Duges has an interesting paper on the colour variation of the lizard *Gerrhonotus imbricatus*, and illustrates his observations with a coloured plate. In another paper he describes the footprints of a mammal of the genus *Felis* from the Upper Pliocene or Pleistocene deposits of Verdolaga. The impressions correspond closely with those made by the recent *F. concolor*. Some footprints of birds found with the *Felis* are referred to *Oxyechus vociferus*. Professor Herrera concludes his valuable memoir on the climate of the Mexican Valley and the biology of vertebrates, and gives a chart showing the range in height of mammals, birds, reptiles, and batrachians. The paper is of considerable value to the student of geographical distribution.

In geology, Dr. J. N. Rovirosa writes on the structure of the Teapa Valley, and gives some notes on the Cocona Cave, which has a length of 492 metres. Messrs. J. G. Aguilera and E. Ordoñez contribute an explanation of a new geological sketch-map of the Mexican Republic, which has been prepared under the direction of Dr. Antonio del Castillo. The map accompanying the paper shows Quaternary deposits round the greater part of the coast, and extending over a large area of the country, especially to the north. Starting from the Gulf of Mexico, and going west, we cross successively a narrow band of Tertiary deposits, a broad area of Cretaceous, with here and there a little Jurassic or Liassic, and reach the western half of the country which is almost wholly composed of eruptive rock. A few patches of cretaceous deposits occur, and some metamorphosed (Palæozoic ?) masses. Volcanoes, solfataras, and supposed extinct volcanoes are shown. Ordoñez has a note also on the composition of the Aztec Calendar or Sun Stone of the City of Mexico. He finds it to be a mass of Olivine Basalt (olivine, augite, labradorite, and magnetite), and considers that the labradorite was the first to crystallise. A micro-section of the rock is given.

In botany, Mocino and Sesse continue the Flora Mexicana; Dr. J. Ramirez describes a new species of *P. terostemon* (*P. rotundifolia*); while Mr. P. Maurey describes *Sebastiania ramirezii*, a new Euphorbia. Dr. J. N. Rovirosa writes a sketch of the life of E. P. Johnson, one of the pioneer botanists in Mexico, and contributes a note on the Flora of Tabasco. A list of ferns collected by Hugo Finck in the Cordoba district, and sent to the World's Fair at Chicago, shows 149 species.

ILLINOIS AND ITS STATE GEOLOGIST.

IT is our occasional misfortune to have to call attention to the eccentricities of writers, who, because they deal with scientific

subjects, come within the cognisance of a scientific journal. A year ago, with reference to *Bulletin* No. 3 of the Illinois State Museum of Natural History, we pointed out that fifty-eight new species were "described in a State publication, under the name of a State official; but that only four of the type-specimens were in the State museum, the remaining fifty-four being in the private cabinets of the two authors." *Bulletin*, No. 4, described thirteen new species, the type-specimens all being in the cabinets of the authors. *Bulletin*, No. 5, described thirty-six new species, none of which were in the State museum, and of which the types of thirty-four were in the cabinets of the authors. The 6th *Bulletin*, published on April 5th and now before us, describes forty-two new species, and all the type-specimens are in the private collection of the State geologist and curator of the State museum of Illinois, Mr. Wm. F. E. Gurley, who with Mr. S. A. Miller, is the joint author of the *Bulletin*.

From the scientific point of view, type-specimens in private collections are in the most useless places. All museums, worthy of the name of scientific collections, endeavour to secure as many type-specimens as possible, especially when these specimens come from the localities in which the museums are situated.

Now, consider the delightful nature of the state of affairs at the Illinois museum. The State geologist has amassed a private collection; by describing his specimens in the State publication he has turned a large number of them into valuable type-specimens; as curator of the State museum he has to recognise that the museum is, alas! destitute of these valuable types, and it is his duty to secure them as speedily as may be for the museum, by purchase or otherwise. It is a situation charming in its simplicity; but, English institutions, please do not copy!

Natural History at the Indian Exhibition.

At the Empire of India Exhibition, Mr. Rowland Ward again has an exhibit of Indian animal life in the jungle and on the mountain. It is admitted that the amount of space at Mr. Ward's disposal does not permit of a representation very satisfactory either to the sportsman or the naturalist. The impressive solitude of the jungle is replaced by scenes that remind one rather of the stage of Drury Lane at pantomime time. The crowding of bears, antelopes, leopards, and goats on a few canvas rocks, with heads of *Ovis ammon* stuck in the background like those of Bluebeard's wives, does not constitute a particularly impressive picture. Another single tableau shows the crocodile, buffalo, gaur bison, rhinoceros, black Himalayan bear, black buck, pythons, adjutants, hornbills, tragopans, rose-headed parrakeets, flying foxes, and some dozen other species of mammals and birds. Some sort of excuse for this medley is supposed to be afforded by a muddy pool, but Mr. Ward knows quite as well as we do that this is absurd. Still, the naturalist may be

interested to see many of these animals set up with Mr. Ward's well-known taxidermic skill; and no exception can be taken to the fight between an elephant and two tigers, or to the "frightfully thrilling" situation of a native asleep in his hut while a man-eating panther creeps in at the door. These two tableaux are satisfying to the artist, and it is plain that they are none the less attractive to the public. We hope that Mr. Ward will be able to give many more such exhibitions, and we believe that a little more attention to Nature and less subservience to the "Olympian" style of art would bring him in quite as many sixpences.

ALBATROSS AND PENGUIN ISLANDS.

IN the *Victorian Naturalist* for January a photograph is given of the nests and young of the Pelican, taken on Penguin Island by Mr. H. P. C. Ashworth. The paper accompanying it deals also with a visit to Albatross Island, and describes the curious "caves," formed, apparently, by the disintegration of soft dykes, which cut vertically through the quartz conglomerate, of which the island is composed. It is to be hoped that Messrs. Ashworth and Le Souef will publish the series of ornithological photographs taken by them while visiting this group of islands.

OBJECT TEACHING IN TOWN AND COUNTRY.

DECIDEDLY things are moving. Constantly, some say too constantly, we urge the necessity of a return to nature in our methods of elementary education. The art of printing has done much for man, but the printed page too often inserts itself between our eyes and the realities of the world. Our cry, therefore, has always been—less book-teaching, less giving of information, let children learn for themselves by the old way of the five senses, let science be learned by the individual as it is learned by the race, through observation and experiment. But, as we said, things are moving, and soon there will be little left for us to urge.

In our April Number we mentioned the addition to the Educational Code that permits the time spent in visits to museums under proper guidance to be counted to the children as time spent in school-work. The account of a meeting at the Whitechapel Museum, reported in our News pages, shows that the teachers are taking this permission in earnest, and that there are at least some curators thoroughly in sympathy with the aims of modern educationalists. But, like the text-book, the museum is only a substitute, and in our editorial of April, we put forward the claims of the hedgerow and the quarry to a place in our system of teaching. We rejoice to see that the prophecy on which we ventured is even now being fulfilled.

A remarkable and inspiring circular (No. 369) has just been issued from the Education Department to H.M. Inspectors of Schools.

It is entitled "Object Teaching," and is prefaced with some admirable remarks by Sir George Kekewich. First, he draws the distinction we have so often emphasised between observation of the object itself and information about the object. "It should be always remembered," he says, "that in Object Lessons the imparting of information is secondary to the cultivation of the faculty of observation." He distinguishes object teaching from instruction in natural science: "It is Elementary Science only in so far as it aids the child to observe some of the facts of nature upon which Natural Science is founded; but as it deals with such topics without formal arrangement, it differs widely from the systematic study of a particular science." Science teaching belongs to a later stage of mental discipline. "In Object Teaching the chief interest in the lesson should centre in the Object itself." Summing up the uses of object teaching, Sir George says: "The first and most important is to teach the children to observe, compare, and contrast; the second is to impart information; and the third is to reinforce the other two by making the results of them the basis for instruction in Language, Drawing, Number, Modelling, and other Hand-work. There are, however, other important uses of good Object Teaching. It makes the lives of the children more happy and interesting by opening up an easily accessible and attractive field for the exercise of brain, hand, and eye. It gives the children an opportunity of learning the simplest natural facts and directs their attention to external Objects, making their education less bookish. It further develops a love of nature and an interest in living things, and corrects the tendency which exists in many children to destructiveness and thoughtless unkindness to animals, and shows the ignorance and cruelty of such conduct."

But the chief point in the circular that has attracted our attention is one that may easily be overlooked. After speaking of visits to museums as advantageous in connection with object teaching, it proceeds, "Occasional class excursions out of school hours (or, if the instruction be in accordance with Art. 12 (*f.*) of the Code, in school hours), under proper guidance, will enable teachers both to provide suitable Objects and to confirm previous impressions. It should be borne in mind that Objects, when they are brought into the class-room, cannot be there studied under their ordinary conditions; and therefore it is important by a proper use of such expeditions to let the children see what part the Object plays in its usual surroundings." When we turn to the list of objects suggested as appropriate to these lessons, we find among them "Caves by the sea formed by the waves; caves inland formed by rain dissolving limestone. Springs and running water. Study of flow of a stream. Study of seashore"; while for children in towns are suggested "River or canal, according to circumstances. Atlantic liners. The park or public garden." It is pretty obvious that seashores and Atlantic liners cannot conveniently

be brought into the ordinary class-room; so that outdoor excursions are a necessary corollary of Circular 369. We sincerely hope that the teachers, with whom after all the initiative must lie, will not be afraid of laying on themselves too great a burden, and we trust that they will not be prevented from putting these ideas in force by the apprehension, far too common among them, that a day in the country, or an hour of school time spent anywhere but in the school house, means a loss of marks and a consequent reduction of grant.

SCIENCE AND ART DEPARTMENT.

THE examinations of the Science and Art Department have done good service in setting a high standard for elementary science teaching, especially in evening classes. This is evident from the syllabus published under authority, and becomes still more so from the examination papers and the list of passes. When we consider the hard work, and frequent self-denial, which an approach to the required standards must often mean to students of that class which the whole arrangement is supposed primarily to benefit, it is only fair that an honourable observance of the syllabus should be rigidly adhered to by those to whom the work of examining is entrusted. A correspondent seems, however, to have just reason for dissatisfaction with the botany papers of recent years.

"I write," he says, "as one who has heard many complaints from candidates with regard to the advanced stage of this examination, and also as one who, knowing their opportunities, can sympathise with them. In the first place, they say that it is hardly fair to send a plant for description belonging to an uncommon British order (Apocynaceæ), especially when the only species that has the slightest claim to be indigenous is classed by Watson as a denizen. I have consulted several well-known field botanists resident north of the Midlands, and they—as well as myself—have never met with a plant of this order after rambling over the country for a score of years, and observing nearly all our native plants in a growing condition; we are, in fact, compelled to steal a flower for dissection from some public park when a favourable opportunity offers, as it is never on sale at the florists.

"In the elementary stage a knowledge of only fourteen orders is required, while in the advanced stage an acquaintance with more than ninety is demanded, besides a fair knowledge of physiology and morphology, as well as an acquaintance with a dozen cryptogamic types.

"When a student who (after passing the elementary stage) has been doing his utmost by collecting and examining all the plants he can meet with, to make himself conversant with the greater number of our native orders, finds that his endeavour to get a pass in the first class is entirely frustrated by having handed out to him from the corner of a box a pinch of pinkish fragments between three fingers and a thumb of a superintendent, he certainly feels that the advanced stage in any other subject is much easier and certainly safer. The pinkish fragments in question were such as one can pick up under a vase of cut flowers; and belonged to a cultivated plant of a foreign

genus—*Dicentra*. In the following year a specimen from another foreign genus—*Weigelia*—was sent at the time when *Viburnum Lantana* was in flower, and could easily have been procured. However, he perseveres for three years more, and then presents himself again, when he receives a few withered fragments of what may once have been tiny white flowers; he asks for more, and gets a morsel of an apparently etiolated stem added to his specimen. This turns out to be withered fragments of the inflorescence of a third foreign genus—*Rheum* (garden rhubarb). After two more years he tries again, and is supplied with a maritime plant—*Armeria maritima*; he does not know it, as he has always resided in the heart of an inland town. As the questions are supposed to relate to the indigenous flora only, the candidate naturally avoids gardens when specimens are procurable in the field. The following year he is confronted with *Vinca*. The specimens sent are too meagre, and are in a dilapidated condition; moreover, they are distributed by a person who does not understand the requirements of the case. Small tin boxes are now so cheap that the additional expense of packing each specimen separately would do away with this cause of complaint, and give every candidate the same chance.

"If it is necessary to send botanical puzzles like the above, there should also be sent a representative of some other order, of which a knowledge might reasonably be expected; the candidate might be allowed to describe both specimens. For elementary students, *Delphinium* was certainly not a proper plant to send as a representative of the Ranunculaceæ.

"In twenty-eight or thirty lessons of an hour's duration a teacher is expected to prepare students for the advanced stage, and if he devotes half the lessons to general morphology and physiology, including the gymnosperms and twelve cryptogamic types, he is then expected to impart a practical knowledge of above ninety orders and their 'largest genera' during the remaining fourteen or fifteen lessons; and this largely in the winter—from September to May.

"Could not a summer course for descriptive work be encouraged? In organised science schools this should be insisted on, a record of the plants dissected should also be required, and the written descriptions should be filed and kept for examination by the inspector."

Our "Challenger" Number.

The kind manner in which the public and the Press have welcomed our attempt to furnish a convenient summary of the scientific results of the "Challenger" Expedition is most gratifying to us, especially as one of its results was to exhaust our first issue, though a larger one than usual, within a week of publication. Our second edition was in the hands of the public on July 6th. In it the opportunity was taken to correct one or two slight misprints. One alteration was the change of the word Bryozoa, in Mr. Harmer's contribution, to Polyzoa. Mr. Harmer had written Polyzoa, which he believes to be the correct name to use, and we, not knowing that he attached importance to the word, had altered it for the sake of consistency. We offer Mr. Harmer our apologies. Unfortunately it was not noticed in time that, in Mr. Carpenter's account of the

Pelagic Hemiptera (p. 60, second line from bottom), the word "Italian" was misplaced. It refers to the Expedition and not to the species.

Of the many kind letters that we have received, we will only quote the following:—"Mr. Gladstone offers his very best thanks to the Editor, for the singularly interesting number of NATURAL SCIENCE which he has been good enough to forward to Hawarden. Jul 1, 95."

We learn that a few people have complained that we did not pay enough attention to the chemical and physical results of the Expedition. Our regular readers will understand that those branches of the subject are outside our usual scope, and were, therefore, only dealt with so far as they seemed to appeal directly to biologists or geologists. Another reason might be found in the fact that their inclusion would have swollen our already enlarged number to a size that would have necessitated the raising of its price. Since, however, there may have been some purchasers of the number who suffered disappointment, we make them the best amends we can by offering them, in the present number, an article on the chemical and physical results of the "Challenger" Expedition, for which we are indebted to the kindness of Mr. Ritchie Scott, who, from his long connection with the "Challenger" Office and from his own special studies, is peculiarly fitted to deal with those questions.

One correspondent, who thinks that we treated the Hydroidea somewhat scantly, reminds us of "the gigantic Tubularian, by far the largest of all known Hydroid-polypes." He writes further, "The specimens of *Idia* brought home enabled the structure of this remarkable hydroid to be worked out in a way which would have been impossible with the dried specimens hitherto in the hands of zoologists, and have given occasion to the establishment, not only of a new family, but of an entirely new section of Calyptoblastic Hydroids. The determination of the true and hitherto misunderstood structure of *Grammaria*, and the establishment of the remarkable family of the Perisiphonidæ, afford sufficient evidence that the work of the "Challenger" in this department was not without results which have, to some extent at least, advanced the progress of Hydroid morphology."

We thank our kind correspondent, but we must remind the others, doubtless not few, who have found some sections less fully treated than they could have wished, that a summary of so gigantic a work, that is to be both short and interesting, must inevitably have "the defects of its qualities." It cannot mete out strictly proportionate justice to every subdivision of the natural sciences.

I.

Some Casual Thoughts on Museums.

Part I.

NO question has been more debated recently, and none deserves to be ventilated more in your pages, than the best arrangement of our museums, and especially of our great museums like the one in Cromwell Road. The problem, of course, depends upon the purpose and aim of museums. The old-fashioned notion that they form a kind of dustbin, where all the useless, ugly, eccentric, and curious productions of art and Nature are to be shown together and labelled with fantastic information, is obsolete. This kind of museum is now rapidly disappearing everywhere, and a theory (conceded as a theory by everyone) prevails that every object exhibited should teach something in a definite and precise way, and should be arranged with other objects so that a continuous lesson can be conveyed, and should not include a series of epileptic jumps from Cathay to Peru and from a mermaid to a mouse.

This theory is sound enough as a theory. Its difficulty is in its concrete application. In provincial museums a great many subjects have to be taught with only a limited collection of objects and a limited space. Stratigraphical geology has to be taught as well as the various problems of life, and an object lesson has to be given in the manifold operations of Nature. This involves an entirely different method of arrangement to that convenient in large museums. It can only be carried out by rigidly excluding all kinds of mere "curios," which, having been remitted very often to the stable or the garret, are passed on by some generous patron of science and art to the unfortunate local museum. All this rubbish should be declined or passed on again to where it ceases to be rubbish because it can form part of a series. It should not be difficult to arrange for every local museum a small stratigraphical collection like the one arranged by Mr. Etheridge at the Natural History Museum, only on a smaller scale, with some of the types of fossils ear-marking particular horizons, also a series of typical generic forms from different parts of the animal and vegetable kingdom. This should not attempt too much and not be too large, but every specimen should be as well mounted as possible, so that the fact that these skins really once belonged to living animals should not need a special label to teach us. There

should also be on a small scale a collection to show the anatomy and physiology of life, as displayed in Professor Flower's Index Collections. This might be well done in every provincial museum by making the extent of any one series dependent on the accommodation. A clear, easy handbook should explain the whole collection, written in English and not in that bastard speech, a kind of Tartar jargon, in which every other word is a technical term requiring a dictionary to explain it, and which schoolboys call "beastly dull"—as a matter of fact, all dull men in museums should be pensioned off.

One-half of every provincial museum at least, unless the museum is a very big one, should be devoted to a local collection. It is local collections which ought to form the staple of local museums, the rest being subsidiary. What really interest and are most useful in teaching the greater number of country yokels, are the things they can find about home and know something of at home, and what they should be taught is the vast interest and importance of this kind of knowledge at their elbow when coördinated and arranged. Every object in such a collection should be the best obtainable, and set up as much like Nature as possible, with its natural surroundings and food shown.

What a number of facts and what a mass of knowledge have been accumulated by our workmen's societies in Lancashire and Yorkshire, on the life history of the plants, of the insects, and the land and fresh-water shells of those counties; and what a number of busy people there would be ready and willing to breed obscure moths and beetles, and thus to trace the life stages of many forms where they are still unknown, and to do similar work!

It seems to me that Lord Walsingham's exhibition of butterflies and moths in the British room at the Museum has already made more genuine real naturalists among London boys than all the hideous shows of some of the older parts of the great Museum put together. Such a local collection should also be most accurately labelled by the very best men, and not left to any amateur with two or three books on his shelves. For such collections are not merely intended to amuse the casual crowd, but to help school-boys and other collectors to name their own collections. There should, if possible, be also provided a guide, instructing these inexperienced collectors how to preserve objects, how to detach fossils from their matrix, how to dry plants, etc.; in fact, how to make use of the little knowledge which boys can acquire in the few minutes a day their parents and masters allow them to spare from trying to kill each other at football.

Again, it seems to me very proper that the great museum in Cromwell Road, in addition to its general collections, should contain a special collection of local objects kept together and shown together. This ought to be the type and model for all provincial museums to follow. The great museum is, in fact, the local museum for London—this great empire of London, with a million boys and girls, the great

mass of whom are very poor and forlorn, and have no chance of seeing and knowing what Nature is like, what country flowers and butterflies and birds are like, and who crowd the museum at times quite delighted with what they see. Still more delighted if some casual Philistine, like myself, takes a party of them round and tries to convey to them some rags and tatters of dislocated knowledge. This is one class for which "the British room" provides. There is, however, another class—the great army of London public schoolboys—who come with their specimens to label and to identify, and who also come to patronise and to teach their sisters that crabs are not a kind of fish, and that shells are not half so interesting as their nasty, slimy contents which "the girls" habitually throw away.

The only difference between this particular department of the British Museum and of a provincial museum is that, London being so big and so cosmopolitan, this part of the collection ought to be conterminous with Britain itself instead of with some particular county, and the British collection there ought to be a model for the local collections elsewhere. Is it such a model now? Who can truly say so? If we exclude the butterflies and moths arranged by Lord Walsingham, which are incomparable, the birds' eggs arranged by Mr. Seebohm, and some of the crustaceans and echinoderms, do the rest of the collections fulfil any purpose whatever, except to arouse astonishment and disgust? The mammals are grotesque; they give one the impression that English wild beasts are nearly all suffering from the mange, and that they have habitually a grin on their faces suggesting their living continually with a dentist, while their protruding eyes and misshapen bodies are too grotesque for anything. The Chillingham ox is assuredly unmatched in any show in the world. Nor does one of the specimens show how the animals live, or what food they feed upon. They are merely bad furriers' specimens, and they ought to be carted away.

The birds are almost as bad—for the most part old worn-out specimens, badly stuffed, dirty and dusty, and suggestive of a lumber room. The real collection of English birds, than which nothing could be better and more attractive in every way, is not in the British room at all, but distributed partially upstairs and partially in the room containing the general ornithological collection, where it is quite out of place. The unrivalled series ought to be brought together into a British room, with adequate accommodation, and supplemented by a series of mammals similarly mounted, and all the present specimens in the British room moved off to any limbo whatever.

If we turn from these to the fish and reptiles the case is worse. Such horrors as the fish and reptiles in our museums are, were never contemplated in any scheme of nature. After Frank Buckland, and especially Mr. Else at Torquay, have shown us how to preserve fish so that they look something like fish and not like the properties of a

pantomime, it is shameful to have passed off for so many years on unsophisticated innocent people these goggle-eyed, discoloured, parchmenty denizens of some necromancer's study, as the Almighty's handiwork. The same with the reptiles. If we are to have a show of British natural history, let it be a real show, and not something which the British fisherman, the British game-keeper, and British country children fail to recognize as old friends and old enemies, and which they are obliged to study in the works of Kircher and his friends. There is something to be said for not showing the public any specimens at all, and reserving them for superior people whose book of Nature is not the one whose leaves are found open in the woods and fields, but in drawers and cabinets reeking with arsenic and camphor; I believe they call themselves "systematists." But if we do show specimens, let the best artists we can find make up for what is inevitably gone, by in some fashion simulating the look of living things. Why should we not have some of those realistic plaster casts that they have at the National Museum in Washington, some of which were illustrated in NATURAL SCIENCE for August of last year? They would be an antidote to "the herald's horrors" which are carved in stone all over the Museum walls, and make one wish that a specimen of an architect could be exhibited in the same room with other eccentricities of Nature.

I should like to prolong this homily in another paper or two.

HENRY H. HOWORTH.

II.

Waltzing Mice.[1]

WHATEVER the late war may have done towards increasing our knowledge of Japan and things Japanese, it was the means of introducing to me an interesting domestic animal, the subject of this article.

The mice were obtained from Mr. Haley, of this city, who received them from Japan. The original pair and nearly all the offspring for several generations are white, variegated with black, disposed about the head, nape, and root of the tail. The exceptions are reversions to the colour of the wild brown mouse, and two instances in which the black is replaced by faint buff; the irides of these are pink, whereas those of the other mice are dark.

At first, a visitor probably regards the mice as mere colour varieties of the common white race. A moment's observation reveals the peculiarities of the breed, and attention is rivetted by their strange performances. Early in life they exhibit the tendency which has earned for them the name above applied. When a mouseling leaves the nest its gait consists of an evident attempt to proceed in a straight line; this is frustrated by a tremulous movement of the head, which is nervously shaken from side to side. Shortly, a tendency is exhibited to turn; this develops into a rotatory motion, performed with extraordinary rapidity, which constitutes the peculiarity of the waltzing mouse.

The ordinary routine of daily life is constantly interrupted by this mad disposition to whirl, frequently indulged in for several minutes, and, with an occasional stoppage of a few seconds, continued for hours. The floor of one of Mr. Haley's cages being somewhat rough, the mice actually reduced their feet to stumps

[1] In August, 1894 (vol. v., p. 91), we referred to a paper by Dr. C. Schlumberger, published in the Memoirs of the Zoological Society of France (vol. vii., p. 63), and giving an account of a Japanese *netsuké*, or ivory carving, which represented a family of dancing mice. In his paper, Dr. Schlumberger referred to another by himself on these curious little animals, in *Feuille des Jeunes Naturalistes*, no. 271, p. 110, and a second by Remy Saint-Loup, in *Bulletin de la Société Zoologique de France*, 1893, p. 85. The following note was posted to us by Mr. E. R. Waite before Dr. Schlumberger's paper reached Australia. Since, however, it is an independent account by a trained zoologist, it will doubtless interest English readers, and may throw further light on this peculiar pathological breed.—EDITOR NATURAL SCIENCE.

before it was noticed. Like ordinary mice they sleep during the day, but apparently waltz the whole night long. If, however, they are disturbed during daylight, they leave their bed and work off some surplus energy.

The rotation is so rapid that all individuality of head and tail is lost to the eye, only a confused ball of black and white being recognisable. Very often they spin in couples, revolving head to tail at such a speed that an unbroken ring only is perceived. It is remarkable that they keep perfectly together; this may be attributed to their similarity in size and not to any special faculty they may possess. An upright peg forms a favorite pivot, but even without this guide they would not, in several minutes, cover an area larger than a dinner plate, and they easily spin under a tumbler. Sometimes three or four mice run together, the extra ones then form an outer circle, but as the evident desire is to rotate rather than revolve, more than two seldom work well. An individual generally spins in one direction only, and the majority turn to the left, only a small proportion going "with the clock."

A waltzing mouse may be placed on the ground without fear of it escaping. Should it attempt to do so, it will not proceed far before being seized with a paroxysm, which it will be necessary to work off before further progress can be attempted. These mice may also be kept in a paper box, which would not detain a wild mouse an hour; the process of gnawing the walls of their prison will be so frequently interrupted by the necessity of practising their infirmity that little damage can be done. As with all truly domestic mice, however, no determined effort to escape, such as characterises the wild mouse, is ever attempted, and at most such efforts are to be regarded as an inherited habit rather than a real desire for liberty, for domestic mice do not readily leave when their cages are left open.

The feature of the breed may be due to cerebral derangement, but that the trait is, at the present day, purely hereditary and not acquired by the individual, is shown by the fact that as soon as they arrive at an age when other mice begin to run, these begin to waltz.

They may be compared to tumbler pigeons, and the analogy is close, allowing for differences between an aërial and a terrestrial performance. The plane of motion is, however, quite different, as exemplified by Indian ground tumblers, which, when placed on the ground, turn head over heels.[1] In both cases the affection is the result of perpetuation by heredity of an affliction which would have insured the destruction of a wild race.

EDGAR R. WAITE.

Australian Museum, Sydney,
27th March, 1895.

[1] Darwin. "Plants and Animals, etc.," i., p. 150.

III.

Bud-Variation and Evolution.

MR. L. H. BAILEY has lately published an interesting paper on this subject,[1] treating the well-known phenomenon of bud-variation from rather a novel point of view. He observes that the evolution of the higher animals, at least, has proceeded in accordance with a different law from that of plants, and it is the object of his paper to emphasise the recognition of the fact of asexual evolution in the vegetable kingdom. When we remember that, on the ascending scale of life, the whole of the vegetable kingdom has never risen much above the level of corals, inasmuch as well nigh any portion of the highest plant is capable of reproducing all the phenomena of the entire plant, his contention seems feasible. He observes: "The mere fact that the phyton [or assumed plant unit] may reproduce itself is not the most important point, but rather, that each part of the plant may respond in a different manner or degree to the effects of environment." As no two peas are precisely alike, so no two branches on the same tree are identically the same in every point of structure; for, "variation among the sisterhood or colony of branches is determined by very much the same conditions which determine variation in independent plants growing in the soil. I believe that the primary and most important determinant of this variation is the variation in food supply." Hence follows a struggle for existence among the developing buds of a tree, strictly parallel to that among a number of individuals growing thickly together. There are weakly developing branches and strong branches, and "the survival of the fittest [*i.e.*, the constitutionally strongest] is Nature's method of pruning."

With regard to bud-variation, properly so called, which involves not merely vigour—even if it have that—but some change in form and appearance of the organs it may bear, Mr. Bailey shows that there is abundant asexual variation, and that this variation takes place as readily when the phyton is growing upon a plant as when growing in the soil. Now, every branch or phyton is in an incipient degree, a bud-variety; *i.e.*, as a rule, only in minute or inconspicuous features. Nevertheless, even in these, the practical horticulturist

[1] "The Plant Individual in the Light of Evolution." Address before the Biological Society of Washington, January 12, 1895. (*Science*, new series, vol. i., p. 281, March 15, 1895.)

recognises important differences, for "he instructs his budders to cut buds only from the topmost shoots of the nursery rows in order that he may grow straight, vigorous trees; and every farmer's boy knows that the reddest and earliest apples grow on the uppermost branches, and his father will always tell him that he should never select scions from the centre or lower part of a tree." This practice rests on the principle of acquired characters being hereditary in plants, expressed by M. Carrière, thirty years ago, in the following words[1]:—"Faisons aussi remarquer que les diverses combinaisons faites pour perpétuer les variétés, ou pour en obtenir de nouvelles, reposent sur cette loi générale que, dans la nature, tout tend à se reproduire et même à s'étendre, que par conséquent les modifications peuvent non-seulement devenir héréditaires, mais qu'elles peuvent encore servir de moyen pour arriver à d'autres modifications, à étendre et à multiplier de plus en plus les séries typiques."

Bud-variation, however, as ordinarily understood, consists of only the more extreme and readily noticeable forms of variations, as when a nectarine is borne on a peach tree, or laciniate or variegated leaves appear on a tree that ordinarily has entire, or green leaves, respectively, and the like.

The important point which Mr. Bailey proves is, that bud-variation and seed-variation are not only strictly parallel phenomena, but are really of one kind; for horticulturists can bring selection to bear on plants raised from bud-variation, or plants propagated by buds, and so "improve" them and fix varieties, just as they do with seedlings. The author quotes the following passage of Darwin's[2]: "To my surprise I hear from Mr. Salter that he brings the great principle of selection to bear on variegated plants propagated by buds, and has thus greatly improved and fixed several varieties. He informs me that at first a branch often produces variegated leaves on one side alone, and that the leaves are marked only with an irregular edging, or with a few lines of white and yellow. To improve and fix such varieties, he finds it necessary to encourage the buds at the bases of the most distinctly marked leaves, and to propagate from them alone. By following with perseverance this plan during three or four successive seasons, a distinct and fixed variety can generally be secured."

As another parallel between bud- and seed-variation, Mr. Bailey says: "It is well known that the seedlings of plants become more variable as the species is cultivated; and it is also true that bud-varieties are more frequent and more marked in cultivated plants," many plants having great "sporting" tendencies, as in certain sections of roses, chrysanthemums, etc. The general cause is the same for both kinds of variation, namely, the environment; or in the words of Darwin:

[1] *Production et Fixation des Variétés dans les Végétaux*, p. 9. Paris, 1865.

[2] "Animals and Plants under Domestication," i., p. 411.

"When we ask ourselves what is the cause of any particular bud-variation, we are lost in doubt, being driven in some [all ?] cases to look to the direct [or indirect] action of the external conditions of life as sufficient."

Again, as crossing is common among flowers, so graft-hybrids are possible. One stock or scion may so influence the other as to cause it to produce buds partially or greatly like itself. Seeds of a cultivated scion when grafted on a wild stock may be so affected as to reproduce the wild form. Other instances are well known.

Mr. Bailey next draws attention to the seminal reproduction of bud-varieties, as, *e.g.*, the moss-rose. On the other hand, as "some seed-varieties will not 'come true' by cuttings, so also there are some bud-sports which will not."

Lastly, "in proof of the further similarity of bud- and seed-variations, each class follows the incidental laws of external resemblance which pertain to the other class. For instance, there are analogous variations in each, giving rise to the same kinds of variegation, the same anomalies of cut and coloured foliage, of creeping branches, parti-coloured fruit, and the like . . . The most expert observer is not able to distinguish between bud-varieties and seed-varieties; the only way of distinguishing the two is by means of the records of their origins."

Mr. Bailey next discusses more fully the most important point of truly asexual variation as a source of the origin of species. He enumerates several plants which have produced, under cultivation, many varieties, but have never been known to bear seed—such as the pine-apple, banana, bread-fruit, weeping willow, "top" onion, and horse-radish. Of fruit-trees, he describes the interesting case of the Newtown pippin apple, which has been widely spread by grafting. He tells us that it originated upon Long Island, New York. In Virginia it varied into the "Albemarle Pippin," an inferior kind. It has varied again in the extreme North-Western States, "being much longer, and bearing distinct ridges about the apex."

This last form has varied again in New South Wales, the ridges becoming more marked, and is called the "Five-crowned Pippin." That the causes are attributable to the environment, such as climate, etc., is obvious, from the fact that "most north-eastern varieties of apples tend to take on the elongated form in the Pacific North-West, to become heavy-grained and coarse-striped in the Mississippi Valley and the Plains, and to take other characteristic forms in the higher lands of the South Atlantic States."

He notes the rapidity with which the asexual changes are sometimes brought about: "Within two years the Chilian strawberry varied or departed from its wild type so widely as to be indistinguishable from the common garden strawberry; so that we have here a most interesting case of sexless evolution, but one in which the

subsequent generations reproduce these characters of sexless origin by means of seeds."

Mr. Bailey further observes that, since evolution by asexual variation can take place under cultivation, it will be able to do so in nature, whenever plants can be multiplied and distributed by detachments from their vegetative system, as many water plants are (*Hydrocharis*, *Elodea*, etc.), and numerous land plants, by bulbils, runners, offsets, etc.

Darwin has collected a number of instances of "bud-variation by suckers, tubers, and bulbs,"[1] as among potatoes, dahlias, phlox, tulips, etc. Since, therefore, new varieties and races can be established by bud-variation alone, there is ample evidence to prove that "a progressive evolution of plants can take place without the aid of sex."

The rationale of all this is, that variation in plants is always due, directly or indirectly, to the influence of the environment; and it matters not whether the plant be raised from seed or from the vegetative system, the new surroundings can act on both precisely in the same way. This, I have proved, *e.g.*, taking slips and seed from the wild spiny rest-harrow, in two years I have converted both into a spineless form not distinguishable from the so-called species *Ononis repens*, L, by growing them in a constantly saturated atmosphere.

Mr. Bailey concludes his article by refuting Dr. Weismann's theory and observes: "I should bring in rebuttal the result of direct observation and experiment to show that given hereditable asexual variations are often the direct result of climate, soil, or other impinging conditions. As a matter of fact, we know that acquired characters may be hereditary in plants; if the facts do not agree with the hypothesis, so much the worse for the hypothesis."

Now it is in this power of evolution, in the vegetable kingdom, by wholly sexless means, that Mr. Bailey sees a fundamental difference between the evolution of plants and that of the higher animals at least.

GEORGE HENSLOW.

[1] *Op. cit.*, i., p. 384.

IV.

Chemistry and Physics in the "Challenger" Report.

ALTHOUGH the interest of zoologists in the "Challenger" Expedition and its results, as embodied in the fifty volumes of *Report*, chiefly centres upon the zoological section and its revelations of life in the great oceans, yet it should not be forgotten that the unique services rendered by the Expedition to oceanography, in its chemical and physical aspects, are not only valuable in themselves, but have a profound bearing on marine zoology. The fundamental conditions of an animal's existence are expressible as physical data: what is the average temperature of its habitat, and to what range of temperature is it subjected? how much oxygen can it have? how much sunlight? and, in the case of marine organisms, the amount of salinity and pressure may become questions of importance. All these questions are for the physicist and the chemist to answer, and to him must the naturalist apply if he would render a full account of marine life, especially in the consideration of such general questions as the distribution of species and the like.

On board the "Challenger" the chief physical work was the determination of the specific gravity of samples of water collected from the surface every day; from the bottom at sounding-stations by means of a slip bottle attached to the line; and, wherever practicable, from intermediate depths of 25, 50, 100, 200, 300, 400, and 800 fathoms from the surface. A characteristic feature of the Expedition's work was the determination of the temperature of these water samples *in situ*, as was also the collection of samples from various depths all over the great oceans.

The chemical work of the ship-laboratory consisted in extracting the gases from, and determining the carbonic acid in, as many samples as possible. Besides this, a very large number of samples of sea-water from the surface, the bottom, and intermediate depths were carefully stored in glass bottles for more detailed examination at home. This was the daily programme for some three and a half

years. "It is difficult," writes Dr. Murray, "for anyone, except those who actually witnessed the daily work at sea, to form an adequate idea of the labour, skill, and continuous effort required to carry on these observations in all sorts of weather, and to form, and bring home successfully, collections and observations like those which have resulted from Mr. Buchanan's exertions."

After the return of the Expedition to England, Mr. Buchanan proceeded to analyse the gas samples which had been brought home; but he being unable to proceed with the chemical work of the Expedition, all the material was handed over to the late Professor Dittmar for completion of the work. The resulting volume, published six years after, in 1884, besides being a valuable addition to oceanography, contributed not a little to the art of chemical analysis, in which Professor Dittmar was a recognised master; and as a piece of scientific work it is a monument of painstaking and unwearied search after accuracy, doubly instructive in its mathematical habit of thought and its simple record of persistent trial and failure until the desired result was accomplished.

The first really great work on the chemistry of ocean-water was that of Georg Forchhammer, who, in 1864, just twenty years before the appearance of Dittmar's Report, published his paper, "On the Composition of Sea-water in different parts of the Ocean." Beyond his demonstration of the existence in sea-water of constituents hitherto unsuspected, his great service to science consisted in showing that the proportions of the cardinal constituents of sea-water salts, the chlorine, sulphuric acid, lime, and magnesia, vary very little throughout the great oceans. After Forchhammer's work no analysis of sea-water was of any value unless executed with the highest attainable precision, and it was in full consciousness of this that the late Professor Dittmar entered upon the complete analysis of his seventy-seven samples of ocean-water, and endeavoured to furnish, as he says, "if nothing more, at least a valuable extension of Forchhammer's great work."

The small quantity of each sample at his disposal (from one to two litres) rendered impossible the determination of the minor constituents (some twenty-two in number) enumerated by Forchhammer, so he restricted himself to the determination with great accuracy of the chief components, sodium, potassium, magnesium, calcium, and sulphuric and hydrochloric acids. This direct determination of the sodium, which had been omitted by Forchhammer for want of an accurate method, was a great advance, and led to a very valuable result, viz., that the equivalents of base were always in excess of the sum of the equivalents of sulphuric and hydrochloric acids, thus establishing beyond doubt the presence of considerable quantities of carbonates in sea-water.

Combining acids and bases in an arbitrary way, we may state Dittmar's final results as follows:—

	Average Composition of Ocean-water Salts.	Average Composition of 1 litre of Ocean-water.
Sodium chloride	77·758	28·9980 grms.
Magnesium chloride	10·878	4·0568 ,,
Magnesium sulphate	4·737	1·7665 ,,
Calcium sulphate	3·600	1·3425 ,,
Potassium sulphate	2·465	0·9193 ,,
Magnesium bromide	0·217	0·0809 ,,
Calcium carbonate	0·345	0·1287 ,,
Total salts	100·000	37·2927 ,,
Water		989·7073 ,,
Weight of litre in grammes		1027·0000

The last column gives the average composition of a sample of ocean-water of specific gravity 1·027.

Professor Dittmar's work fully confirmed Forchhammer's conclusion as to the constancy in composition of the sea-water in various parts of the ocean, and further showed that the depth is without influence on the composition of the salt, if we limit ourselves to the ratios between chlorine, sulphuric acid, magnesia, potash and bromine. This last constituent, occurring as it does in very small quantities, and being considerably utilised by sea-plants, was considered by Dittmar to be more liable to local variation than the others. From the determinations of the lime, however, there would seem to be no doubt that its proportion increases with the depth. This result of the separate analyses was confirmed by the analysis of mixtures of superficial and deep waters, and also by the alkalinity determinations, deep waters almost always showing a higher alkalinity than superficial ones. Let us explain what is meant by alkalinity. All sea-water is alkaline to test paper[1] and reagents, and as Dittmar's complete analyses always showed an excess of equivalents of base over those of sulphuric and hydrochloric acids, all this alkalinity must be due to the base united with carbonic acid. Dittmar (after Tornoe) measured this alkalinity by determining how much carbonic acid was required to form normal carbonates (*i.e.*, similar to carbonate of lime) with the base of the sea-water not united with sulphuric and hydrochloric acids. Carbonic acid being a weak acid is probably combined chiefly with the weakest bases—that is, with the magnesia and lime; and the magnesium having a tendency to form double salts, probably forms a double chloride with the abundantly present sodium chloride, leaving the greater share of the carbonic acid to the lime. At any rate, the "alkalinity" measures the potential carbonate of lime, and may fairly be presumed to measure approximately the actual carbonate of lime present. Thus the higher alkalinity of the deeper waters argued a higher percentage of carbonate of lime.

The gaseous contents of sea-water—oxygen, nitrogen, and carbonic acid—are of great importance to the biologist, for, in view of

[1] This was observed as early as 1777 by Bergmann; Von Bibra (1851), although an independent discoverer of the fact, was certainly not the first, as supposed by Tornoe and Dittmar.

the constancy in composition of ocean-water, it is chiefly the quantities of gas in the water which determine the capability of any region of the ocean for supporting life. Owing to the greater solubility of oxygen in sea-water as compared with nitrogen, the air contained in normal sea-water, whence fishes obtain their oxygen, is twice as rich in oxygen as the atmospheric air; but, owing to the slower circulation of the waters, it is much more liable to deterioration; and quite stagnant water, as under peculiar conditions in some Norwegian fiords, and notably in the Black Sea, may become so impoverished in oxygen as to be quite unable to support animal life of any order higher than bacteria. This deprivation of oxygen is accompanied by a rise in the proportion of carbonic acid derived from the carbon of the animal matter which the lost oxygen has oxidised.

The whole of the oxygen and nitrogen and a minute fraction of the carbonic acid are derived from the atmosphere, but the major part of the carbonic acid is formed in the water.

The presence in sea-water of carbonates and loosely combined carbonic acid had been acknowledged long before the outset of the "Challenger" Expedition. In 1777, Bergmann attributed the alkalinity of sea-water to magnesium carbonate; but the general impression was, that there were only minute traces of carbonates, and that the carbonic acid existed mostly in a state of absorption. It was found, however, that the carbonic acid in sea-water was only completely driven out upon distillation nearly to dryness, if no reagents were added. This was considered to be due to the peculiar affinity of some sea-water salt for carbonic acid, various salts being accredited with this power by different investigators. Tornoe then showed by a long series of combined determinations of alkalinity and carbonic acid that in North Atlantic waters the carbonic acid was present as bicarbonate; and Dittmar's discovery of the surplus of base over hydrochloric and sulphuric acids confirmed this result and established it generally, clearing up finally this long vexed question.

In general, the result of Buchanan's determinations and Dittmar's further work in this connection may be stated in brief by saying that "ocean-water from any place or depth contains its surplus base in the form of normal carbonate combined with additional carbonic acid, which latter in the majority of cases falls short of, in a minority of cases comes up to, and very rarely exceeds, that which would produce bicarbonate." Dittmar's final summary as to the distribution of carbonic acid in the ocean is as follows:—

1st. Free carbonic acid in sea-waters is the exception. As a rule, the carbonic acid is less than the proportion corresponding to bicarbonate.

2nd. In surface-waters the proportion of carbonic acid increases when the temperature falls, and *vice versâ*.

3rd. Within equal ranges of temperature, it seems to be lower in

the surface-water of the Pacific than it is in the surface-water of the Atlantic Ocean.

The sea being dependent on the atmosphere for its supplies of oxygen and nitrogen, the absolute quantity of these gases present in a sample will depend on the temperature and barometric pressure at the time of absorption. Thus, at 760 mm. and 2° C. (35·6° F.) one cubic foot of sea-water will absorb 13·42 cubic inches of oxygen and 25·67 cubic inches of nitrogen, while at 27° C. (80·6° F.) it will only absorb 8·15 cubic inches of oxygen and 16·13 of nitrogen. The normal proportion of oxygen in sea-water air is thus from 34½ to 33½ per cent., but while the inert nitrogen remains unaltered, the oxygen ever tends to diminish.

In surface-waters the total quantity of gas in solution was found to decrease as one went from the poles to the equator, as also did the proportion of oxygen. In high latitudes the proportion of oxygen is sometimes so high as to amount to supersaturation, 35·01 per cent. being found near the Antarctic Circle. A similar phenomenon was observed by Tornoe in Arctic waters, wherein he found as much as 36·7 per cent. of oxygen. The lowest percentage of oxygen was found in warm regions where oxidation processes are rapid, and fell as low as 32·2 per cent. towards the south-east of the Philippine Islands. This contrast between the percentages of oxygen in warm and cold waters was most pronounced in the water strata from 100 to 300 fathoms in depth. Bottom waters were almost always poorer in oxygen than intermediate waters from great depths. No water was found to be absolutely devoid of oxygen, although in waters from great depths the quantity was often very small. Thus, from a station on the 30th parallel, to the north of the Sandwich Islands, the dissolved air contained only 3·84 per cent. of oxygen, amounting to about one cubic inch per cubic foot of water. From the amount of nitrogen present there must have been originally fourteen cubic inches of oxygen present.

The discussion of Deep-Sea Deposits involved a considerable amount of chemical work, consisting chiefly of analyses of samples of deposits, minerals, corals, manganese concretions, and organic remains, 161 analyses altogether being recorded in the Report on Deep-Sea Deposits. The majority of the analyses were executed by the late Professor Brazier, of Aberdeen; the remainder by Anderson, Church, Dittmar, Gümbel, Hornung, Klement, Renard, Ross, and Sipöcz.

This Report also includes a remarkable analysis of manganese nodules, with special reference to the presence or absence of the rarer elements, carried out with all the resources of modern analysis by Professor Gibson, of Edinburgh. Space will not permit us to quote it in full, but we may mention that he detected and estimated the amount present of sodium, potassium, ammonium, magnesium, calcium, strontium, barium, manganese, cobalt, nickel, zinc, thallium,

iron, alumina, copper, lead, molybdenum; also sulphates, chlorides, phosphates, vanadates, carbonates, silicates and titanates, and found traces of lithium, tellurium, and fluorine.

Professor Tait has contributed two valuable Reports bearing on Ocean Physics. The first of these is on the pressure error of the "Challenger" thermometers. In view of the high pressure existing at great depths, a correction of at least half a degree Fahr. for every mile under the sea had been assigned to the thermometers, although protected. This was considered by Professor Tait to be excessive, and he proceeded to investigate the matter and found that pressure alone can affect the reading of the thermometers when let down into the sea, and that in no case does the correction exceed one-seventh of a degree per mile of depth. Other experimenters had been misled in their laboratory experiments by the heating effect due to sudden compression.

The above Report gave rise to a number of interesting questions bearing on Ocean Physics, which were subsequently investigated and formed the basis of his Report on some of the Physical Properties of Water. This includes the investigation of the compressibility at high pressures of fresh and sea-water, of solutions of common salt, and of glass and mercury; it also takes up associated physical questions such as the change of temperature produced by compression, the internal pressure of a liquid, and others.

Both these papers involved a great amount of experimental work and contain much that is of permanent value to pure physics.

A. RITCHIE SCOTT.

V.

Biological Theories.

VIII.—THE CRYSTALLINE LENS.

TWO theories as to the action of the lens in the vertebrate eye are extant, and I have been familiar with both for so long a time that I do not know where I first learnt either of them. Of these, one is to be found in almost any good text-book of physiology, and in some text-books of physics. The other is well-known to physicists, and is the obvious and necessary outcome of the treatment of optical questions by the method of considering wave-surfaces instead of "rays."

The first and almost universally adopted doctrine treats the lens of the eye like the lens of a photographer's camera, and involves the calculation of the focal length of the lens from its "mean refractive index" and the curvature of its surfaces. The second is based rather on a knowledge of the internal constitution of the lens than on its external conformation. Before entering into it let me describe an exceedingly simple experiment which ought to be seen by every student of physiology.

Remove the lens from the eye of a rabbit and press it very slightly between two slips of glass so as to reduce its anterior and posterior surfaces to two parallel planes. Now look at a printed page through it and note that, though its surfaces are parallel and plane, it magnifies strongly. Hold it up, still between the glass slips, at a suitable distance in front of a white screen, and note that this body, now no longer a lens, still produces a clear image.

From the results of this experiment, which I hope every reader will try for himself, it follows that the first of the two doctrines is erroneous, and that neither curvature of the surfaces nor the "mean refractive index" of the lens has any important influence in the formation of the image, and that the function of the lens depends almost entirely upon the arrangement within it of media of different optical densities.

The second doctrine, the true one as it seems, is that when a light-wave falls upon the lens and traverses it, that portion of the wave which traverses the central portion of the lens, having to traverse media in which its velocity of propagation is less than in the peripheral portions, is retarded in its passage to a greater extent than are other portions of the wave, and thus a wave-front which was before plane

(as in a beam of "parallel rays") becomes strongly concave, that is, the "rays" become convergent.

The representation in diagrams of the effect of the lens is not difficult if contours of wave-fronts are drawn instead of "rays," and the mathematical difficulties may be avoided in lectures to medical students, by using only those formulæ which do not involve either radii of curvature or indices of refraction. The exact mathematical treatment of the problem, from the point of view of the second doctrine, appears to be almost impracticable; for the measurement of the refractive index at each point in the lens, though theoretically possible, would be both exceedingly laborious and also liable to very great error. A very slight tremor indeed in the razor, at the moment of cutting the section of the lens, would lead to considerable error; and the use of a cover-glass would bring in new errors which it would be practically impossible to eliminate. Such exact measurements are, however, not necessary for the purposes of the physiologist: all he requires is to show roughly that the refractive index does increase as we pass from periphery to centre of the lens; in fact, the only experiment he requires to make is the one I have described.

C. HERBERT HURST.

VI.

The Newcastle Museum of Natural History.

THE Newcastle Museum had its origin in a collection of birds and miscellaneous objects made by Marmaduke Tunstall, Esq., of Wycliffe-on-the-Tees, in Yorkshire, in the latter half of last century, and it was then known as the "Tunstall" or "Wycliffe" Museum. This collection was purchased after Mr. Tunstall's death (in 1790) by George Allan, Esq., of Blackwell Grange, near Darlington. This gentleman had already collected a series of curiosities, but the accession of the Wycliffe specimens and other augmentations gave him so considerable a museum that he had the objects arranged and labelled in special rooms and opened to the public. The collection at this period consisted principally of birds; but other Natural History specimens, certain relics of antiquity, coins, seals, and curiosities formed part as well. The "Allan" Museum was thus comparatively rich, and the records show that it attracted a large number of visitors. After Mr. Allan's death, which occurred in 1800, the collection, with other things, was advertised to be sold, but a number of Newcastle gentlemen, members of the Literary and Philosophical Institution, were successful in buying the museum privately before the sale, and thus it was that this important collection was secured to Newcastle. It formed a nucleus around which the magnificent collections yet to be mentioned have been gathered.

The "Allan" Museum was placed in the old committee-room of the Literary and Philosophical Society for a few years. In 1829 a section of the members of that society formed themselves into a Natural History Society, and, acquiring ground from the parent institution, built special rooms which did duty for many a year as the home of the Newcastle Museum. Here the collections remained and grew until it became perfectly hopeless to do justice to even a part of them; but at length a vigorous effort to provide a worthier and larger habitation was made by many enthusiastic members of the society, chief among whom we must note the well-known Mr. John Hancock. This classic building (the Hancock Museum) was opened by the Prince of Wales in 1884.

As has been said, large accessions had been made to the museum collections. Among such additions acquired by gift and purchase we must note the Hutton, the Charlton, and the Cookson

collections of minerals; a collection of Russian minerals presented by the late Emperor Nicholas of Russia ; the Loftus, the Prior, the Dew-Smith, the Kirkby, the Atthey, the Abbs, the Trevelyan, the Hutton, the Goring, and the Duff collections of fossils; the Robertson and the Winch herbaria of British plants, and the Bowman herbarium of British and Foreign plants; the Tankerville collection of corals, sponges, etc.; the Alder collection of Mollusca; the Hodge collection of Crustacea and Echinodermata; the Bold collection of Coleoptera and other insects, Wasserman's Lepidoptera, Raine's Lepidoptera; Albany Hancock's Tunicates, Nudibranchs, etc.; and the even better known collection of British birds and eggs and nests made by John Hancock. The Raine collection of the nests and eggs of British birds is also a very interesting and extensive one. Many original drawings, principally Bewick's birds, vignettes, etc., and Albany Hancock's original drawings of the Nudibranchiata, together with numerous books, have also been handed over to the care of the museum. It needs only a glance at the above list to show that the museum is not only rich in specimens, but that many of these are very valuable type-specimens. The Hutton collection of fossil plants from the Coal-Measures is especially noteworthy as forming the basis of, and furnishing the figures for, the "Fossil Flora of Great Britain," by Lindley and Hutton (1831–37). Another most interesting collection of fossil fishes is that which was formed by the late Thomas Atthey, and which was presented by Lady Armstrong. The specimens used in the preparation of Alder and Hancock's Ray Society monograph on the Nudibranchiata, although not on exhibition, are preserved in the museum. A large portion of the museum is devoted to the Hancock collection of birds. We shall notice other important specimens if we now make a rapid survey of the rooms.

As we approach the museum we find that it occupies a commanding position at Barras Bridge, a convenient and pretty part of the city. It is within easy reach of the Medical College, and the College of Science is almost next door. It is surrounded by trees, and the grounds are laid out as a rock garden, which an enthusiastic member of the committee keeps in a never-failing succession of bloom. At the back of the building are large cages, in which are kept certain live animals, and at present one can see there a llama, a herring gull, a peregrine falcon, and a condor. Entering the museum we find ourselves in a corridor decorated with innumerable ruminant horns. Here we can secure a guide to the museum, a guide to the Hancock collection of birds, a catalogue of the local fishes, and another of the local fossils; all the work of the curator, Mr. Richard Howse. There are more ambitious catalogues which we need not at present mention. Passing to the right or left we find that the collections are arranged in three large rooms well-lighted from the roof, in galleries around these rooms, and in large and spacious corridors. A series of workrooms is placed in the back of the

building. The collections are displayed in floor-, double desk-cases, and in wall-cases. A uniform white or light background is used throughout, though some of the light-coloured specimens, as can easily be imagined, would be better displayed against a dark background. We find, too, on looking a little more closely, that though the labelling of the main groups is boldly and carefully done, the specimen labels are often very indistinct. There are no special features of display or arrangement; no attempt to teach particular lessons, such as we find in so many modern museums.

The specimens have been simply arranged in systematic or linear order as far as the arrangement of the cases and other circumstances permitted. The first room is devoted to the Invertebrata, the Pisces, Amphibia, Reptilia, and Mammalia; the second to the Hancock collection of birds; and the third holds part of the exhibition of fossils and minerals, which extends into two of the corridors. A third corridor has received bulky rock and mineral specimens and the large cetacean possessions.

The Protozoa, the Medusæ, and the Actinozoa are illustrated by models, and other invertebrate groups by more or less complete series of specimens, chief among which we note the Alder and Hancock Mollusca, and the Insecta. The fishes are altogether represented by stuffed specimens and a few skeletons, including one or two disarticulated skulls. *Gymnurus Banksii* and *Trachypterus arcticus* are conspicuous among the more important forms. Along with the stuffed specimens of Amphibia and Reptilia we see a few spirit preparations. These might with advantage be added to, and attempts made to follow Hamburg, for example, in using shallow, upright, rectangular bottles, so that the specimens might be shown in horizontal, natural attitudes. Among the mammals, we note in passing the Marsupial Mole, *Notoryctes typhlops*, an embryo of the Greenland whale, as well as other interesting cetacean skeletal parts, and the head of a Chillingham bull, while the skeleton of a Chillingham cow may be seen in one of the corridors.

The Hancock collection of birds is a magnificent display of numerous examples of the art of the master. The general collection is effectively shown in separate wall-cases, and a few artistic groups occur in the middle of the room. "How not to do it" is illustrated in some relics of the Allan Museum, shown in the gallery. These specimens, however, are very interesting as having been used by Bewick for his illustrations. The great Auk from this collection, unique in being in immature plumage, and another specimen got by Hancock, are, of course, more than interesting, so is the egg which the visitor may see on application, along with many beautiful plaster of Paris casts made and painted by Mr. Hancock.

The fossils are arranged according to the horizons of their occurrence, and to enumerate them here would be to make this article endless. They have been well arranged (largely in wall-cases

provided with wooden terraced shelves), as we should expect when we consider that Mr. Howse, the curator, is a well-known palæontologist. The minerals are arranged conveniently under the heads of the metals. A model showing the formation of the district, and maps or sections would be valuable to the student of these collections.

Enough has been said to show that the museum acts a worthy national part in preserving so much valuable material to the country; that this material has been of considerable importance in furthering the study of certain sections of natural science; and that the cases present an arrangement and display which make the museum an important factor in the local work of higher education. Many specialists have been attracted to it by the wealth of its collections in the departments which it may be said to profess specially, and which have been pointed out. A complaint is often made that the museum is not much taken advantage of. But this cannot be altogether true, for on holidays, at any rate, it is, I understand, well attended. Little attempt, it must be said, has been made to attract visitors by providing striking curios to look at; and it is not at all desirable to do so. Order and neatness in preserving, arranging, and labelling are far more to be desired than cases designed to catch the eye of the curious. A well-arranged case containing tastefully prepared specimens is an attraction in itself, and the visitor will be quite able to appreciate such. A museum must be considered as a means for collecting and preserving material of value in the departments it professes, that this may be of use for the furtherance of research in those departments. And such specimens as it may be found convenient to exhibit should be so arranged and labelled that the lesson they teach may be easily read by those who will. Such an arrangement is made with a distinct educative purpose, and not as a show of curiosities. And looked at in this light, the Newcastle Museum will be found to occupy a first-class place among provincial museums. The curator is a cultured naturalist; and the cases show that the museum's taxidermist is a man who turns out splendid work.

Of course, it will easily be seen that the specimens on view illustrate the natural bias of the individual collectors, and do not, on that account, represent Nature's balance; and this should be kept in mind. There are also some developments which might be suggested other than those pointed out above, but this is not the place to do so.

ALEXANDER MEEK.

College of Science, Newcastle.

VII.

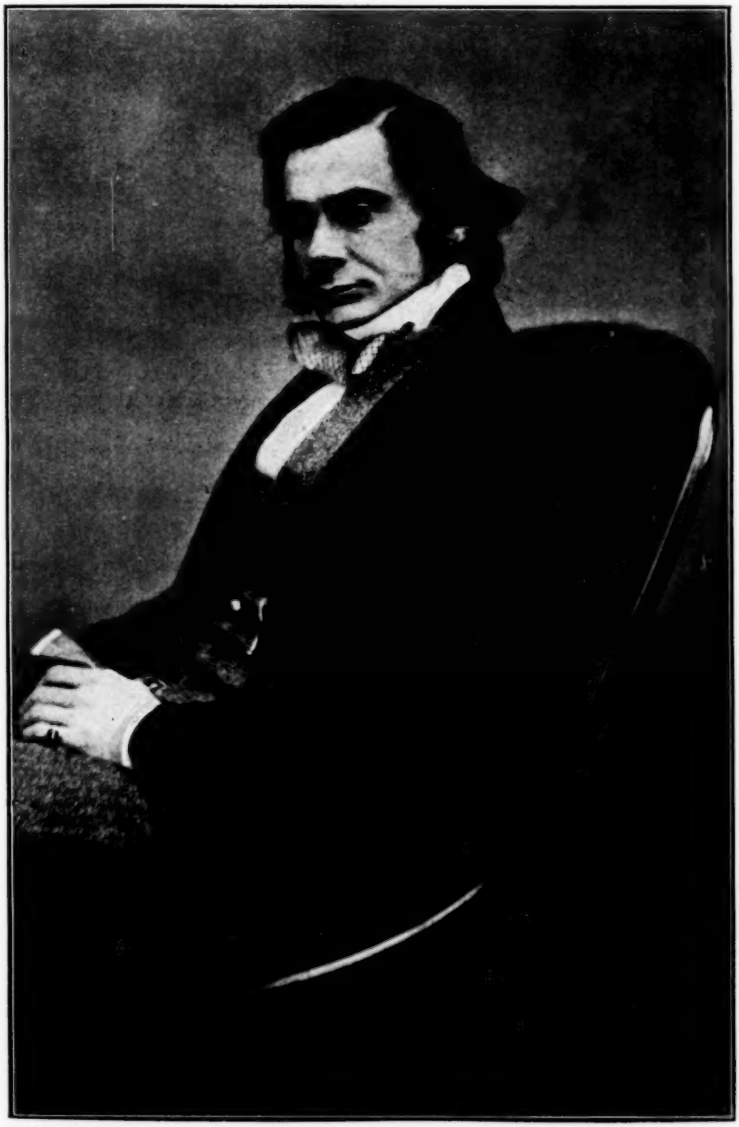
Huxley.

THOMAS HENRY HUXLEY was born at Ealing, on May 4, 1825. His father was master in a small school there, and in this school the boy received his first instruction. Little is known of his early life, but it is certain that he early obtained a mastery over languages, more especially German, afterwards to be of the greatest service in his scientific labours. He entered Charing Cross Hospital Medical School in 1842, where he had the advantage of hearing lectures from Wharton Jones. He took the M.B., London, in 1845, the M.R.C.S. in 1846, and entered the naval service, going to Haslar under Sir John Richardson. Contact with so distinguished a traveller and naturalist had no doubt much influence on Huxley's career, and we find him appointed to the "Rattlesnake," then fitting out for a surveying voyage to the Great Barrier Reef, New Guinea, and the Louisiades, under Captain Owen Stanley. He made good use of his opportunity, and even while away sent home several papers on natural history subjects of such importance, that already on his return in 1850, he found himself a man of considerable reputation. He was immediately elected a Fellow of the Royal Society, and received the Royal medal from that body in 1852. Leaving the service in 1853, he succeeded Edward Forbes the following year as Professor of Natural History to the Royal School of Mines. In the same year he became Fullerian Professor to the Royal Institution, and was appointed Examiner in Physiology and Comparative Anatomy to the University of London. In 1849 his first great work, on "Oceanic Hydrozoa," appeared in the publications of the Ray Society; his earliest paper, on the root-sheath of the hair, having appeared when he was a medical student. He was appointed Croonian Lecturer in 1857, and in the same year assisted Tyndall in the study of glaciers. In 1862 Huxley was President of the British Association, a post he also held in 1870, the year of publication of his famous "Lay Sermons." A keen interest in educational matters led him to seek election on the London School Board in 1870, a position only held by him for two years on account of his failing health. In 1869 and 1870, too, he held the presidency of the Geological and of the Ethnological Societies, and in 1873 he became one of the secretaries of the Royal Society, being elected to the presidency in 1883. From 1881 to 1885 he was Inspector of Salmon Fisheries, in which post he succeeded Frank Buckland, and he held for many years the office of Dean at the Royal College of Science. Retiring in 1885 from most of his offices, Huxley gave himself up almost entirely to literary work. He was Lord Rector of Aberdeen University in 1872, and again served in Scotland in 1875 as Professor of Natural History to the University of Edinburgh, during the absence of Sir Wyville Thomson. Huxley's best known works, beyond those already quoted, are "Lectures on the Elements of Comparative Anatomy" (1864), "Lessons in Elementary Physiology" (1866), "Manuals of the Anatomy of Invertebrated and Vertebrated Animals" (1870 and 1871), "Elementary Biology," in conjunction with H. N. Martin (1875), "The Crayfish" (1881), "Critiques and Addresses" (1873), "American Addresses" (1879), "Science and Culture" (1881). He was the great exponent of the Darwinian theories, and his "Man's Place in Nature" (1863) did much to smooth acceptance of the truths elucidated by Darwin and his fellow-workers. His later controversial writings are too fresh in memory to need recapitulation here. One of Huxley's last efforts was to re-issue, in collected form, an edition of his works, other than scientific, in nine volumes. He was chosen a Privy Councillor in 1892. In late years Huxley lived at Hodeslea, Eastbourne, where he died, after a protracted illness, on June 29, 1895, at the age of seventy. He was buried on July 4, at the cemetery of St. Marylebone, East Finchley.

I.—AT THE AGE OF THIRTY-TWO.

OTHERS besides those who knew, in earlier life, the great and beloved chief who has so recently passed from among us, will find interest in the portrait of him, at the age of thirty-two, which accompanies this note (Plate xviii). It was taken in the year 1857, and was one of a series of photographs of the Fellows of the Royal Society, published at that date by Messrs. Maull & Polyblank. I have cherished it ever since, recalling as it does to me the earliest impression which his wonderful personality made on my boyish mind. It shows us Huxley in the full prime of manhood—as yet unknown to popular fame, and even three years later to be spoken of by the *Times* as "a Mr. Huxley," when, at the British Association meeting, he demolished Dr. Wilberforce, the Bishop of Oxford. When this photograph was taken, Huxley had been only two years Professor at the School of Mines; he was seeing his "Oceanic Hydrozoa" through the press, his Croonian lecture on the Vertebrate Skull was ready, but not yet delivered.[1] After his first lecture at the Royal Institution as Fullerian Professor, only a year or two earlier, he had been so exhausted by the nervous strain of addressing a popular audience that he had gone home to bed at four o'clock in the afternoon. He had only made Darwin's acquaintance a year before the date of this portrait, and the "Origin of Species" was not published till two years after it. It was this grave, black-browed, fiercely earnest face, which three years later turned its steady gaze on the too venturesome Bishop who, in the discussion at Oxford on Darwin's views, had declared that some men seemed to have special information as to their own ancestry, and that he would like to hear from Mr. Huxley whether it was by his grandfather's or grandmother's side that he was related to an ape. Then said Huxley, in an undertone, to a friend at his side, "The Lord hath delivered him into my hands," and he rose to reply. "He spoke with force and eloquence and a self-restraint that gave dignity to his rejoinder," says an eye-witness of the scene. According to the late John Richard Green, then an undergraduate (quoted by Frank Darwin in his father's "Life"), the conclusion of Huxley's speech was as follows: "I asserted, and I repeat, that a man would have no reason to be ashamed of having an ape for a grandfather. If there were an ancestor whom I should feel shame in recalling, it

[1] Between the period of his return from the voyage of the "Rattlesnake" and his appointment at the School of Mines (1851–1855), Huxley had produced a large number of valuable memoirs on Histology and on the Structure of Invertebrata, published chiefly in the *Quarterly Journal of Microscopical Science* and in the volumes of the Royal and of the Linnean Societies. This is not the place in which to enumerate them; but besides these I should like to cite especially (as showing his great activity and industry) his translation in conjunction with Mr. George Busk of Kölliker's "Histology," his translations in the series of "Scientific Memoirs," edited by himself and Henfrey, his article in the *Medico-Chirurgical Review* on the Cell-theory, his article "Tegumentary Organs" in Todd & Bowman's *Cyclopædia*, and numerous unsigned communications to the *Literary Gazette* and other periodicals.



B. Dellagana, Sc.] [*Photo. by Maull & Polyblank.*

THOMAS HENRY HUXLEY.

1857.

UNIV. OF MICH.

AMERICAN MUSEUM
OF
NATURAL HISTORY

would be a *man*, a man of restless and versatile intellect who, not content with an equivocal success in his own sphere of activity, plunges into scientific questions with which he has no real acquaintance, only to obscure them by an aimless rhetoric and distract the attention of his hearers from the real point at issue by eloquent digressions and skilled appeals to religious prejudice."

Thirty-four years later, just a year ago this August, the same face was seen once again at the same Association's meeting in the same University city. Huxley, with his hair now silver-white, and his shoulders adorned with the scarlet gown of a D.C.L., rose once more to do battle for the great doctrine of development. With the same precision and the same cold courtesy with which he had rebuked S. Oxon long ago—he now, as it were, nailed Lord Salisbury's admissions to the table; no retreat was possible. The doctrine ridiculed in 1860 was accepted by all in 1894.

E. Ray Lankester.

II.—As a Zoologist.

In looking through Huxley's zoological work, one of the first observations one makes is that in an important respect it resembles the work of younger generations of zoologists, rather than that of his immediate predecessors and contemporaries. Huxley had a great knowledge of the literature of his subject; his own contributions were always illuminated and explained by being put in contrast or in sympathy with the allied investigations of other naturalists. I am unaware at what period he learned to read German, but his earliest papers show that he had made himself familiar with the best work done on the Continent and in England. It is true, of course, that scientific men read French and German before the time of Huxley; but the deliberate consultation of all the authorities available has been maintained in historical succession since Huxley's earliest papers, and was absent in the papers of his early contemporaries.

There were two sharply marked periods in his zoological work. The periods, naturally enough, were separated by the appearance of the *Origin of Species*: but it is a curious accident that in each period Huxley's attention was directed conspicuously to the group of animals that attracted least attention among other zoologists. Most of his papers published before 1859 dealt with invertebrates, though the morphology of these received little attention from others until zoology, quickened by its acceptance of the doctrine of evolution, concerned itself above all with the lowlier types of life. The greater part of what he published after 1859 dealt with vertebrate anatomy. The explanation of this merely is that his "Rattlesnake" material, and matters directly arising from it, occupied the first part of his career. The second part was determined chiefly by his connection with the Geological Survey. His most important contributions to

science in this period were upon vertebrate morphology. One may notice here the singular circumstance that although an immediate result of Darwinism was a great increase in embryological investigation, Huxley contributed little or nothing to it.

The first important paper he published was communicated to the Royal Society, in 1894, by Stanley, the Bishop of Norwich. This was the well-known account of the morphology of the Medusæ. He showed that these were composed of an ectoderm and an endoderm; that they were all possessed of thread-cells; that the generative organs were external. He united them with the hydroid and sertularian polypes, and thus laid the foundation of the Cœlenterata. He compared the inner and outer layers of the members of this group with the serous and mucous layers of the vertebrate embryo. Thus, although in later days he made little further contribution to embryology, it is to him that one of the most important generalisations of embryology is due. In 1851 he contributed to the *Proceedings* of the Zoological Society an almost equally important set of memoirs upon Ascidians. He verified Chamisso's discovery of alternation of generations in *Salpa* and *Pyrosoma;* a discovery upon which doubt had been thrown. He described the endostyle in these, and stated, for the first time, that it was a structure common to all Ascidians. He discovered the true nature of *Appendicularia*, which Chamisso had united with *Cestum veneris*, Mertens with the pteropods, and of which Mueller had stated his inability to discover the affinities. He had read and been interested by Von Baer's theory of recapitulation, but he went beyond Von Baer, and made use of the doctrine in the modern fashion. Von Baer implied no more than the existence of a closer resemblance between embryos than there is between adults of different groups. Huxley compared the adult state of Medusæ with the larval state of higher animals; and he pointed out that *Appendicularia* typifies the larval condition of other ascidians. It must be admitted, however, that although in these particular cases he had reached the recapitulation theory, the doctrine as such was not present in his mind. For, in 1853, at the Royal Institution, we find him stating in so many words the view of Von Baer, "An insect is not a vertebrate animal, nor are its legs free ribs (as Geoffroy St. Hilaire thought). A cuttlefish is not a vertebrate animal doubled up. But there is a period in the development of each when insect, cuttlefish, and vertebrate have a common plan."

Lecturing at the Royal Institution in the same year, he expounded another important generalisation that has become a commonplace of modern biology. He identified the protoplasmic part of the cells of plants with the protoplasm of animal cells, declaring that the material in which the life of animals and plants resided was identical. He distinguished between the morphological and the physiological aspects of Schwann's cell-theory. From the anatomical point of view, he declared the theory to be of fundamental importance, agreeing with

Schwann that the cell was the unit of structure. On the other hand, he held that cells were not the physiological units. It is interesting to notice that, although for many years afterwards physiologists were at variance with him upon this point, in the last few years the tendency has been growing stronger and stronger to discard the cell as a physiological unit.

The next great contribution to science was the famous paper upon the morphology of the cephalous Mollusca. This suggested a homology between the arms of cephalopods and the gasteropod foot, a suggestion which for long was almost universally accepted. It contained an account of a schematic mollusc, the illustrious parent of Ray Lankester's more famous child. He assumed that some chiton-like mollusc was nearest the archetype, and that the various forms of gasteropods were derived by twistings of the primitive straight form. The cephalopods were morphologically identical with gasteropods, while the lamellibranchs were modifications of the gasteropod type. He separated the ascidians from the other "molluscs," although he did not go the length of elevating them into a group of equal importance.

We have mentioned what seem to us the most striking points in his pre-Darwinian work. Reading it in the light of our modern knowledge it seems marvellous that he had not declared himself openly an evolutionist. But, as he says himself, he was in a state of suspense regarding the permanence or impermanence of specific forms. He had abandoned the Mosaic notion of separate creations; but, until the importance of Natural Selection had been suggested by Darwin, the problem of species had not aroused any special interest in his mind. It is worth noticing that he had paid little or no attention to specific forms. He had already coined the word "species-monger." The generalisations he had made, although they fitted well with the dynamical view of organic forms that we now hold, fitted equally well with the statical view of Cuvier and Owen.

But, once convinced, Huxley threw himself into the battle for Darwinism, with all the splendid vigour of which he was possessed. "I am sharpening my beak and claws," he wrote to Darwin in November, 1859. Perhaps the earliest and most vigorous blow he struck for Darwin was an anonymous review of the *Origin of Species* in the *Times* of December 26, 1859. The opportunity came to him by a chance. Mr. Lucas, one of the regular staff, and an acquaintance of Huxley, received the book for review in the ordinary routine of his work. But he was ignorant of science, and being much occupied, consulted Huxley, who wrote all but the opening sentences. In those days a great daily journal had the importance in floating a scientific book that it now has with a literary treatise. Huxley's diplomatic avoidance of the prejudices of the readers, and his enthusiastic approval of the method and contents of the volume had a most important influence; and the review had the effect most

pleasant to read of now, of cheering Darwin, who was smarting under the ill-informed and ill-natured notices in the *Athenæum* and so forth.

Huxley, with Lyell and Hooker, were the persons to whose judgment Darwin looked forward with most interest; and Huxley, who was first of the three to become a convert, remained for many years the chief exponent of Darwinism. It is not necessary to enter into the details of the conflict; it is in the knowledge of all that it was Huxley who made most converts among scientific and educated persons, and that it was his brilliant rhetoric and intolerable satire that drove the champions of dogma from their position of blustering abuse.

As I have already said, much of Huxley's work after 1859 was determined by his connection with palæontology; it is here dealt with by Mr. Smith Woodward. The later zoological work was chiefly upon vertebrates, and its striking feature was the series of advances it made in classification. Thus, he grouped together the birds and reptiles, inventing the term *Sauropsida* for them. His classification of birds, based in the main upon osteological characters, is the foundation of all the modern classifications. His arrangement of the mammals is the basis of the existing classifications. His treatise upon the homologies of the ear-bones was a great advance upon current views; although other observers, chiefly those who pay attention to embryology, have considerably modified the homologies he accepted. His great paper on the skull and pectoral fin of *Ceratodus*, and on the archipterygium and its relations to fins and limbs, left a permanent impression upon vertebrate morphology. Here he first clearly distinguished the typical ("hyostylic") fish-skull from that ("autostylic") of the mud-fishes, chimæras, and higher vertebrates. His elaborate work upon anthropoid apes, although in certain points it has not been accepted as final, completely upset those anatomists who disputed the practical identity of structure in man and the apes.

If Huxley was great as an investigator, he was even greater as a teacher. Probably no one man ever wrote a set of books that have been read by so many students, and have had so much influence upon methods of education. His introductory primer, written for Macmillan's series, has gone into innumerable editions, and has formed the method of thinking in half the children who have been to school since it was published. His book upon physiography has created a new industry; and although, from what I saw of students and teachers of physiography during two years in which I was occupied in directing and inspecting elementary scientific education in a Midland county, I am convinced that the invention of this selection of the tit-bits of sciences was an educational disaster, still the invention was a great achievement. On the other hand, Huxley's elementary text-book of physiology has probably been as

useful as his "physiography" was deplorable. The text-books of vertebrate and invertebrate anatomy remain the most brilliant and logical expositions of comparative anatomy in existence.

P. Chalmers Mitchell.

III.—As Palæontologist and Geologist.

Huxley himself records that when he received the offer of the vacant Professorship of Natural History in the Royal School of Mines, in connection with the post of Naturalist to the Geological Survey, in 1854, he informed the Director-General (Sir Henry de la Beche) that his acceptance of the office was merely provisional, since he felt no interest in fossils. He was an ardent physiologist, and the purely morphological facts of palæontology did not at that time appeal much to his mind. In a lecture delivered at the Royal Institution in the following year, he even regarded the study of fossils as hopeless in seeking for confirmation of the doctrine of evolution. "There is," he concluded, "no real parallel between the successive forms assumed in the development of the life of the individual at present, and those which have appeared at different epochs in the past. . . . The particular argument supposed to be deduced from the heterocercality of the ancient fishes is based on an error, the evidence from this source, if worth anything, tending in the opposite direction."

Within a year, however, the new Professor began to be deeply absorbed in his pursuits, and soon co-operated with Salter in the determination of fossils for the Geological Survey. The mere systematic work of defining and naming genera and species never appeared to interest him, even to the end; but the determination of the structure of the extinct forms of life, with a discussion of their affinities on the basis of his own results, provided long exercise for his almost unrivalled powers. By 1876 he had accomplished so much that the Geological Society of London awarded him its highest and most coveted distinction, the Wollaston Medal, in recognition of his services to geological science. His latest contributions to the study of fossils were read before the Royal and Geological Societies of London so recently as 1887.

Huxley's earliest notes, published in association with Salter, were a technical description of some supposed fish-shields from the Downton Sandstone, near Ludlow (1855), and a discussion of the affinities of the Devonian Crustacean, *Himantopterus* or *Slimonia* (1856). He also contributed to the Geological Society's *Journal* an independent description of the Carboniferous Crustacean, *Pygocephalus cooperi* (1857). The anomalous structure of the supposed fish-shields from the Downton Sandstone, however, appears to have particularly excited his interest; and this led to a series of investigations of the early Palæozoic fishes, which by 1861 completely revolutionised existing knowledge of the subject. In a paper published by the

Geological Society in 1858 he gave a detailed description of the structure of the shields of *Cephalaspis* and *Pteraspis*, finally demonstrating that these remarkable Devonian fossils must be vertebrates of some kind. He even speculated (as it now appears) somewhat wildly, remarking on the certainty that these ancient creatures must be either ganoids or teleosteans; hence, said he, the earliest fishes were not the lowest in the scale, as was commonly assumed. His most original memoir of all appeared three years later as a "Preliminary Essay upon the Systematic Arrangement of the Fishes of the Devonian Epoch," forming the greater part of Decade X in the *Memoirs* of the Geological Survey. Here, for the first time, the fringe-finned fishes (Crossopterygii, as they were then termed) were clearly separated from the higher ganoids, and an entirely new idea was thus introduced into the method of classification. The recognition of the Crossopteryii was the first step to our modern conception of the evolution of the fish-class. We now recognise that all the earliest types of fishes had lobate fins, while these have gradually become shortened up and replaced by long dermal fin-rays in the more modern types.

The Crossopterygian fishes were investigated by Huxley in great detail, and his memoir of 1861 was followed in 1866 by another Decade of the Geological Survey dealing exclusively with the family of Cœlacanthidæ. Here this group was first scientifically defined, and it was particularly described as an example of a persistent type. The various genera of the family, from *Cœlacanthus* of the Lower Carboniferous to *Macropoma* of the Upper Chalk, differ from each other only in the slightest particulars; while the individuals representing them are comparatively abundant throughout the whole series of strata in which they occur.

Huxley's tentative conclusions as to the other Devonian fishes, however, have not stood the test of subsequent research so satisfactorily as his results from the Crossopterygians. Whatever the anomalous fish *Coccosteus* may be, present knowledge seems to demonstrate that it has not the remotest connection with the Siluroids, with which Huxley compared it. There can also be little doubt that *Cephalaspis* and *Pteraspis* are limbless creatures below the fishes; while the Acanthodians are almost certainly specialised Elasmobranchs.

The work on the fringe-finned fishes seems to have been first stimulated by the Rev. John Anderson, D.D., who submitted to Huxley some beautiful specimens from the Upper Old Red Sandstone of Fifeshire to be described in his well-known volume on "Dura Den," published in 1859. The required contribution was duly made, and then followed the memoirs to which we have just referred. These may truly rank as monographs, involving much laborious research. In the same category may also be placed the memoirs on the gigantic Siluro-Devonian Crustacea (in collaboration

with Salter in 1859), on *Glyptodon* (*Phil. Trans.*, 1865), on Belemnites (*Mem. Geol. Surv.*, 1864), and on reptilian bones from the Triassic Sandstones of Elgin (*Mem. Geol. Surv.*, 1877). Most of Huxley's researches in palæontology, however, were desultory, with special reference to the successive questions of broad philosophy which presented themselves to his mind at different times. At one period the Labyrinthodontia interested him much, as being on the borderland between fishes, amphibians, and reptiles. He thus described *Anthracosaurus* from the Coal-Measures of Northumberland, *Loxomma* from the Lower Carboniferous of Scotland, several small forms from the Coal-Measures of Kilkenny, Ireland, besides skulls from South Africa and other interesting fragments. At another time Huxley, simultaneously with Cope and Phillips, was suddenly impressed with the remarkable resemblance between the hind-quarters of certain dinosaurian reptiles and those of the ostrich-like (struthious) birds. This led to valuable papers on the small Wealden dinosaur he named *Hypsilophodon*, on *Megalosaurus*, on the supposed dinosaurian bones from the Trias of Bristol, and on other more fragmentary remains from South Africa. He concluded by separating *Compsognathus* from the dinosaurs proper, then grouping these together in a major division, "Ornithoscelida." In expanding the idea, he and his contemporaries expressed themselves a little too confidently as to the bridged gap between birds and reptiles, which was then supposed to be filled; and while gratefully accepting the new facts, subsequent writers have refused to adopt, to any noteworthy extent, Huxley's innovation in nomenclature. In 1875, there came the discovery that the gradual formation of the false-palate, which throws back the internal nostrils to the top of the throat in existing crocodiles, could be traced among the fossil crocodiles. Hence, his paper read before the Geological Society of London on the "Evolution of the Crocodilia." This, again, states many truths, and is as important as his earlier discovery (made simultaneously with Owen) of the reptilian nature of the supposed fish-scutes, *Stagonolepis*, from Elgin. As in the case of dinosaurs and birds, however, the conclusions concerning the evolution of the crocodiles are now proved to have been pushed a little too far, the problem of their early ancestry not being quite so simple as it appeared to be in 1875. The papers on *Telerpeton* (1867) and *Hyperodapedon* (1859, 1869, 1887), reptiles from the Triassic sandstones of Elgin, are also important as emphasising the small differences to be observed between these old types and the existing lizard, *Sphenodon*. Finally, his visit to America enabled Huxley to co-operate with Professor Marsh in the now famous paper of the American professor on the ancestry of the horse, as revealed by the discoveries of early Tertiary hoofed animals in the United States.

More might be recorded, but this brief statement will give some idea of the value and fundamental importance of Huxley's contri-

butions to the progress of Vertebrate Palæontology. His eagerness to penetrate the deeper mysteries may perhaps have sometimes led him astray; while his superficial acquaintance with some subjects on which he professed to make authoritative statements, exposed him to the severe criticism which he occasionally merited and received from Owen and other contemporaries. But his influence on progress cannot be measured solely by his own writings. He inspired many younger workers, by his personal example and advice, to follow the same line of research; and he left the Geological Survey well equipped with an accomplished naturalist, who has worthily followed in his footsteps.

This constant study of fossils, and the intimate practical acquaintance with them thus gained, could not fail to reverse entirely Huxley's earlier judgment as to their bearing on the doctrine of evolution. Thus it was that at York, in 1881, he could affirm before the British Association that, if zoologists and embryologists had not put forward the theory, the palæontologists would have had to invent it.

The problems of Palæontology naturally awakened some interest in Geology, and Huxley found time to undertake the secretarial duties of the Geological Society of London for a period of four years from 1859 to 1862. He was then elected President of the same Society for the years 1868–70. His only contributions to purely geological subjects were three addresses, one as deputy-President in 1862, the others as actual President in 1869 and 1870. The first is noteworthy for two reasons. In it he proposed the term "homotaxis" for the conception which is now familiar to every student; he perceived (with many of his contemporaries) that two distant rock-formations containing similar fossils could not be scientifically termed "contemporaneous." There was no proof of their having been formed at the same time; indeed, the facts of "provinces" and migration were rather antagonistic to the idea of contemporaneity. He therefore proposed that they be termed "homotaxial," in reference to their occupying one and the same position in the geological sequence of strata. The second feature of interest in the 1862 Address is a series of remarks, chiefly based on negative and insufficient evidence, on the persistence of certain types of living things throughout long geological periods; and these "old judgments," as he termed them, needed a good deal of revision in his Presidential Address of 1869. This and his famous plea on behalf of the geologists for more time since the cooling of the globe than physicists then allowed, do not admit of being abstracted. They are examples of Huxley's best style, and must be read to be appreciated. They are among the classics of geological literature.

A. SMITH WOODWARD.

SOME NEW BOOKS.

The Museums Association.

Museums Association. Report of Proceedings. . . . Fifth Annual General Meeting, held in Dublin, June 26 to 29, 1894. 8vo. Pp. 260, 15 plates. To be had of the Secretaries to the Association: Sheffield and York. Price 10s. to non-members.

The issue of this Report has been delayed by difficulties with the preparation of the plates, until just before the opening of the 1895 meeting. The Report shows no falling off in the activity of this energetic Association, which now numbers thirty-seven museums and 102 associates; while we are informed that the number of members and associates present at the meeting was larger than in any previous year.

The opening address of the President, Dr. V. Ball, whose lamented death has been so recently announced, has already been published in full in the pages of Natural Science (vol. v., p. 21); and need not be further alluded to.

It is impossible to turn over the pages of the Report without feeling that the Association fulfils its purpose of "the extension of individual experience, and the mutual interchange of ideas." It has become almost a platitude to remark on the difference between the "modern" museum and its predecessors; and the Report for 1894 contains enough modern ideas to perplex seriously a curator of the old type. Those who are ready to make use of the experience of others will derive great advantage from the study of the Report. Every curator knows how often the acquisition of a new specimen involves the designing of a special arrangement for exhibiting it. The authorities of the Science and Art Museum at Dublin have exercised great ingenuity in the elaboration of devices for this purpose, and Mr. H. B. White contributes a paper which is full of information on this subject. The general principles on which to construct a show-case, the suspension of a whale's skeleton weighing some seven or eight tons, the frames used for pictures, the exhibition of coins which require to be looked at from both sides, and many other subjects are here treated; and some are illustrated by figures drawn to scale. Mr. W. B. Pearsall describes a convenient arrangement for exhibiting large series of isolated teeth and other similar objects in such a way as to permit of their being examined from all sides. Mr. F. A. Bather gives an account of fifteen Colonial museums which he has visited, and of the collections and fittings which he has noted in those museums. There are also suggestions for the arrangement of mineralogical and botanical collections, and an illustration, by Messrs. W. E. Hoyle and H. Bolton, of the application of the system of "fractional" cataloguing to Palæozoic fossils.

Dr. H. O. Forbes advocates the centralisation of type-specimens in London, Edinburgh and Dublin. There is much to be said for

this proposal; but provided that certain provincial museums contain special collections which compare favourably with the best of the same kind elsewhere, the advantages of separating the type-specimens from the rest of the collection are not all on one side.

Mr. G. H. Carpenter's paper on "Collections to Illustrate the Evolution and Geographical Distribution of Animals" deserves more special notice. The attempt to increase the educational function of museums is certainly a laudable one; but the method employed has its dangers as well as its advantages. Mr. Carpenter has selected such subjects as "Natural Selection," "Variation," "Life-history of Individuals," and so on; and has illustrated them by means of a small number of specimens taken from different groups of animals, and explained by means of printed labels. Some exception may be taken to the length of these labels. It may be questioned whether the amount of information which takes up nearly two pages of small print in the Report would not be better given in a small guide-book. If a museum is to keep up to date, it is necessary to alter labels from time to time; and it is obvious that the longer the label the more chance there will be that some statement or name will in course of time be found erroneous, and will vitiate the entire label. The mistake can be corrected with but little trouble in the issue of a new edition of the guide-book. The printed matter is, moreover, the part which is most likely to be neglected in an exhibit which consists of a few specimens explained by a disproportionate amount of label.

The illustrations are not always worthy of their place. The statement that certain animals are flesh-eaters, needs hardly to be illustrated by so obvious an instance as a Spider, nor does it appear necessary to call special attention to the fact that a Tiger's teeth are structures for offence. Although I would not appear to disparage the system as a whole, or the way in which it has been carried out in the present instance, it seems to me that the illustration of truisms is only one of the dangers which are to be avoided. The series are in some cases constructed to illustrate a theory, and the explanations given of facts may not really be justified by the actual state of our knowledge. "If you fill cases with processes, showing how brushes are made, within six months perhaps some new feature will be invented, and you will be asked, 'What is the use of showing these things which are not up to date?'" This remark was made by the President in the course of the discussion on another paper, and will serve to point the moral of the above remarks. An indiscriminate use of the system in museums which are not presided over by a scientific curator might easily lead to deplorable results. S. F. HARMER.

THE LIGHT STUDY OF CONCHOLOGY.

MOLLUSCS. By the Rev. A. H. Cooke. BRACHIOPODS (RECENT). By A. E. Shipley. BRACHIOPODS (FOSSIL). By F. R. C. Reed. Being vol. iii. of the "CAMBRIDGE NATURAL HISTORY," edited by S. F. Harmer and A. E. Shipley. Pp. xiv., 535, with text-illustrations and four folding maps. London: Macmillan, 1895. Price 17s. net.

"WHY, you might take to some light study; conchology, now." So said Mr. Brooke in "Middlemarch"; and these are the words that Mr. Cooke takes as his motto, not inappropriately. For it is clear that Mr. Cooke entered on his study with a light heart, and lightness is the characteristic of his work in more senses than Mr. Brooke or Mr. Cooke intended.

We are told in a prospectus, issued at the end of this volume, that the "Cambridge Natural History is intended, in the first instance, for those who have not had any special scientific training, and who are not necessarily acquainted with scientific language. At the same time an attempt is made, not only to combine popular treatment with the latest results of modern scientific research, but to make the volumes useful to those who may be regarded as serious students in the various subjects. Certain parts have the character of a work of reference." The value of this volume has, therefore, to be estimated from two distinct points of view.

NATURAL SCIENCE has already alluded to the very interesting nature of that part of the work addressed to the lay reader and to the outdoor naturalist (Fig. 1). The chapters dealing with such subjects as "Tenacity of Life," "Self-burial of Snails," "Showers of Shells," "Shells as Money," "Oysters under the Romans," and "Snails as Medicine," are undoubtedly such as the cheap bookseller would describe as "good reading," and have already proved a happy hunting ground for the daily press and the popular weeklies. But there is real value in the collection of a large number of observations on molluscan bionomics, a branch of his study which the laboratory zoologist is too apt to overlook. It would, perhaps, have been more convenient for those who are expected to use this volume as "a work of reference," had these valuable notes been subjected to a little more arrangement and co-ordination. The deposition and hatching of eggs in *Helix* and *Limnæa*, which forms a section in chapter ii., would have been better placed in chapter v., which is specially devoted to the subject of reproduction. This is one of many instances of confused arrangement, which might have been avoided had Mr. Cooke or his editors regarded their duties in a less light manner.

FIG. 1.—A. *Strombus mauritianus*, which mimics B. *Conus janus* in shape. Both from Mauritius. This instance was quoted in our vol. vi., on p. 301.

FIG. 2.—*Xenophora* (*Phorus*) *pallidula*, Reeve. A specimen that has "decorated its body whorl exclusively with long and pointed shells." From a "Challenger" specimen in the British Museum, × ½.

In reading these interesting chapters, one or two remarks have suggested themselves, which are here offered in no censorious spirit, but merely as suggestions for a possible second edition. On p. 11, is this sentence, "The problem of the origin and mutual relationship of the various forms of molluscan life is of extreme subtlety. . . . But there is one branch of the Mollusca—the land and fresh-water genera—whose origin is, comparatively speaking, of recent date, and

whose relationships are therefore less likely to have suffered complete obliteration." The Devonian and Carboniferous periods are not usually treated with such irreverence. But, apart from that, the argument is curious: if all molluscs arose first in the sea, surely those modified for land and fresh-water conditions must have their origin more obscured than molluscs that remain marine. "Snails as Barometers" is the heading of a paragraph on p. 50; but the subject thereof is snails as hygrometers. A short time ago there was a note in NATURAL SCIENCE on *Xenophora* (Fig. 2); Mr. Cooke has an idea that when this genus coats its shell with foreign objects, "sometimes the selection is made with remarkable care" (p. 64); one would like evidence that the apparent selection is due to anything else than the nature of the surrounding objects. As instances of molluscs that can leap away from their enemies, Mr. Cooke, on p. 65, mentions the Strombidæ, *Terebellum*, and *Trigonia;* he might have added the common *Pecten*, with which one can experiment any day. The following statement on the same page seems a trifle imaginative: "Many Cephalopoda emit a cloud of inky fluid, which is of a somewhat viscous nature, and perhaps, besides being a means of covering retreat, serves to entangle or impede the pursuer." "The Mollusca," it is said on p. 67, "are not much mimicked by creatures of different organisation"; to the few instances here given one may add the

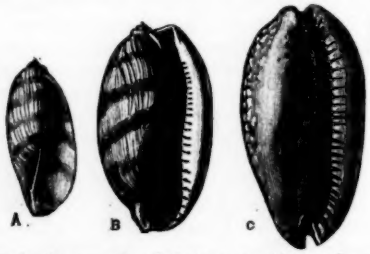


FIG. 3.—Three stages in the growth of *Cypraea exanthema*; from specimens taken at Panama.

curious resemblance of the annelid *Autodetus* to the gastropod *Protocalyptræa*, both in the Devonian rocks of New York (*see* J. M. Clarke, *Amer. Geol.*, xiii., p. 327). In his cases of commensalism Mr. Cooke might include the strange story of the worm, the gastropod, the coral, and the bivalve, related by Bouvier (NAT. SCI., vol. v., p. 86). The section on Variation is valuable; this and the numerous figures of stages of growth may possibly help to check the rash coining of new specific and varietal names (Fig. 3). But we fail to see why specific differences should be confined to "*structural difference* in the organisation of the animal (as distinct from that of the shell alone)." Surely the shell is as much a part of the animal as, say, the liver. The slight calcification of *Mya arenaria* and *Tellina balthica* in the eastern parts of the Baltic is ascribed to "the violent changes of temperature which are experienced in the Baltic" (p. 84). Might not the greater freshness of the water in that part be a still more potent cause, just as it is in the case of *Littorina* (p. 93)? On p. 137, speaking of the dibranchiate cephalopods, the author says, "It is not yet known how the spermatophores find their way into the hectocotylus, or how the hectocotylus impregnates the ova of the female"; thanks to Racovitza this statement is no longer true (*see* NAT. SCI., vol v., p. 321). On p. 400 we are told how fast *Chiton* can walk, and how it rolls up like

a woodlouse; but we are not told, perhaps because the fact was too familiar, how it sticks to its stone like a limpet when one attempts to detach it.

Chapters x. to xii. give a summary of our knowledge of the geographical distribution of the Mollusca, especially of the land and fresh-water species. The value of this, which is already considerable, might have been increased by a closer attention to the geographical changes of the later geological periods.

It is, however, when he turns to the deeper questions of morphology and classification, that "the serious student" will have reason to complain of the author's light treatment. Here, indeed, Mr. Cooke reminds us of "the poor cat i' the adage, letting *I dare not* wait upon *I would*." All the reviewers in scientific journals have noticed how he admits with Pelseneer that the Pteropoda are related to the Tectibranchiata, being derived from the Aplysioidea and Bulloidea, and how, though he places them in the Opisthobranchs, he nevertheless separates them from their relatives by the pages devoted to Ascoglossa and Nudibranchiata. The Amphineura are retained in the Gastropoda, but the consequent difficulty of drawing up a description of the Gastropoda is evaded by leaving them without a description. The Cephalopoda, too, which strangely are taken first, are given no general definition. "The classification adopted for the recent Cephalopoda is that of Hoyle ('Challenger' Reports)" (p. v.). Far be it from us to impugn the veracity of the reverend gentleman, but what does Hoyle say to this? Mr. Foord, too, would hardly agree that the fossil Nautiloidea are classified according to his Catalogue, 1888–1891, for in his 1891 part he removed *Bactrites* to the Ammonoidea. Of course, one regrets the retention of the division into Dibranchiata and Tetrabranchiata; Mr. Cooke mentions the other views, but has a remarkably imperfect appreciation of the arguments on which they are based. There is a curious slip on p. 14, where *Dreissensia* is said to be "closely allied to *Mytilus*," although, in the systematic part, the two are referred to distinct orders. The classification of the Pelecypoda is according to Pelseneer and based mainly on the gill-characters. This is doubtless an improvement on the old method, though a palæontologist may regret that no mention should be made of Neumayr's suggestive attempt.

Some strange lapses in morphology are also hardly suitable for the student, unless he be so advanced as to correct them for himself. He will, however, be clever if he discovers what Mr. Cooke means by saying that "the membranous siphuncle" of *Spirula* "is connected with the posterior part of the liver." The shell of *Spirula* is not "of the Tetrabranchiate type"; for it is coiled in the reverse direction and there are other differences. But all Mr. Cooke's remarks on the shell of the dibranchiate Cephalopoda are difficult for a reviewer to characterise. If, with the majority of English writers, he fails to understand the not very obscure homologies of the *Sepia* shell,[1] one does not willingly ascribe this to ignorance or obstinacy. Yet it cannot be lack of intelligence, if only for the reason that so little is required. We are told that the "arms" of the Dibranchiata are modifications of the molluscan foot; but similar information is not vouchsafed concerning those of *Nautilus*, which are uniformly spoken of as "tentacles." On p. 445, under Scaphopoda, it is said, "there is no special respiring apparatus, heart or arterial system, breathing being

[1] As maintained by Voltz, Gegenbaur, Lankester, Steinmann, etc., etc.

conducted by the walls of the mantle." We will not pause to show that this consists but ill with the statement on p. 151 that "in the Scaphopoda respiration is by means of branchiæ"; for that is equally incorrect. The heart of *Dentalium* was first observed by W. Clark, who described its action in 1849 (*Ann. Mag. Nat. Hist.* (2), iv., p. 321). Lacaze-Duthiers, though he saw the structure, did not regard it as a heart; but the recent observations of L. H. Plate (*Zool. Jahrb. Anat.*, v., pp. 325–328, 1892) have proved the point definitely. The heart is a small simple sac situated in a pericardium ventral to the median prolongation of the two nephridia and the stomach. Respiratory chambers are also present in the mantle, on the opposite side to the anus; these, however, are not homologous with the ctenidia of other Mollusca, which some have sought to homologise with the head-tentacles. Had space permitted, a few genial remarks might have been made on Mr. Cooke's treatment of shell-formation and shell-growth, where he has attempted with more valour than success to assimilate modern ideas. He and our readers may be referred to the excellent thesis by Moynier de Villepoix, "Recherches sur la formation et l'accroissement de la coquille des Mollusques," Paris, 1893.

If it has seemed the critic's duty to point out a few blemishes in the book, it is also his duty to praise it for its readable style, in which lapses such as "this must have degenerated their appetites" (p. 33), are not very common. He must also praise Mr. Edwin Wilson for the beautiful illustrations, and congratulate the publishers on their enterprise in attempting a popular Natural History in which the Invertebrata are allowed their fair share of space. The chapters on the Brachiopoda, with which the volume closes, will receive a separate notice. F.A.B.

North Africa.

STANFORD'S COMPENDIUM OF GEOGRAPHY AND TRAVEL (new series)—AFRICA. Vol. i., NORTH AFRICA. By A. H. Keane, F.R.G.S. London: Edward Stanford, 1895. 8vo. Pp. xvi., 639, with nine maps and seventy-seven illustrations. Price 15s.

IN Stanford's Compendium of Geography no volume was more useful than that on Africa, by Keith Johnston, for the subject matter was more limited, and the information buried in sporting journals and travellers' diaries. After passing through four editions, however, that work was hopelessly out of date, and the editor of the series has wisely now abandoned the attempt to remodel it, and trusted to Professor Keane the task of rewriting the whole book. The materials have grown so rapidly that Africa now requires two volumes, and the present one deals only with that part of the Continent north of a line from the Gulf of Guinea to the mouth of the Juba. Professor Keane commences the book by an admirable introductory chapter, opening with the paradox that Africa is a land of contrasts, instead of a land of uniform monotony. He contrasts the dense forests of the Congo, the broad grassy steppes of the interior plateau, and the sandy wastes of the Sahara and the East African Nyika. He compares the low lying malarial deltas and coast plains with the bracing uplands of Mashonaland; the magnificent waterways of the Congo, Nile, and Zambesi, with the areas of inland drainage, and the dry valleys of the Soudan; the arid climate of the Sahara, and its great diurnal range of temperature with the perpetual snows and fogs of Kilima Njaro and Ruwenzori, and the uniform temperature of such humid localities

as Zanzibar. The people present differences no less striking: for the continent is the home of the dwarfs, the Herculean Monbutti and the tall, slim Somali; of the fair Berbers, the black Soudanese, the chocolate Bushmen, and the coppery Suahili. The languages may be uniform over vast areas like the Bantu, or may be a complex of very different groups, as in the negro tribes of the Nubar Fular group. Africa is so often represented as a land of dull uniformity that the contrast worked out by the author is novel and suggestive. No doubt every other continent yields similar contrasts, geographical, climatic, and ethnological, and these are probably even more extensive and striking. In spite of Professor Keane's ingenuity and the amount of truth unquestionably contained in his contrast, one feels bound to admit, that when compared with its size and opportunities, the old view is on the whole the true one.

North Africa is divided into six districts which are described separately. These are the region of the Atlas (including Tunis, Algiers, and Morocco), Tripolitana, the Sahara, the Soudan and the Niger Basin, Egypt and Nubia, and Italian North-East Africa, including Abyssinia and Somaliland. Each of these is described separately, accounts being given of the physical features, ethnography, climate and political customs. Politics occupy a leading place, and as a rule are very fairly treated. The author states that the success of the French in Algeria "goes far to gainsay the trite remark that they [the French] do not know how to colonise." He points out, however, that the French have lost £151,000,000 in their fifty-eight years of occupation, and that the claim that there is now an annual surplus in the Budget is due to the fact that the military charges for the army of 7,000 men are not included. The author does fair justice to the abused Portuguese, and refers to their early explorations. This is the more satisfactory, as one of the faults in the book is that in the references to literature, foreign work does not receive its proper share of notice. Thus, Fischer, on p. 16, is mentioned only casually, and the credit due to the first traverse of the Masai country is awarded to another. The most valuable part of the work is that dealing with the ethnology—this is well up to date. The recent discussion as to the presence of dwarfs in Morocco is referred to, and the classification of the tribes includes the results of most recent investigations. The general natural history is less satisfactory. Casuarinas are said, on p. 468, to grow on the banks of the Webi-Shebeyli, which is almost impossible. The author sometimes trusts for his geology to scattered notes in anthropological journals (as on p. 553), with results that are not very encouraging. He tells us that the Nilotic lands have not been below sea level since pre-Tertiary times, which is a statement that requires serious modification. In one place the conclusions are a little previous; as when we are told on p. 246, that the French have overthrown their enemy Samory, a statement which the news of the past three months has shown to be very far from the truth.

The geographical sketches are clear surveys of the physical features. Many popular misconceptions are corrected, such as that the Nile has its largest volume below Berber, instead of at its mouth, a frequently repeated statement due to the fact that the river receives no tributaries after this point; but this ignores the supplies added by springs upon its bed. The "flooding of the Nile" is also explained as a case of percolation of water through the soil, instead of by flow across the surface as is usually supposed. The ludicrous absurdity of the proposal to flood the Sahara by letting in the waters of the Atlantic is held up to ridicule, and the very limited areas which could

be submerged are indicated. The book is not one which can be summarised; but it may be recommended as a useful, concise and accurate sketch of the geography and ethnology of Northern Africa. The maps are especially worthy of commendation.

J. W. GREGORY.

DISTRIBUTION OF PLANTS.

PLANTESAMFUND. Grundtræk af den Ökologiske Plantegeografi. Af Eug. Warming, Professor i Botanik ved Kjöbenhavns Universitet. 8vo. 335 pp.

THIS new work by Dr. Warming constitutes a most original contribution to the study of the distribution of plants. According to his conception the problems of plant-geography present themselves under two distinct heads, the Floral and the Œcological. The first has been already treated, notably by Grisebach and Drude, but hitherto there has been no text-book dealing with the "œcological" (*δικος, λόγος*) aspect of the subject. In a consideration of *Floral Plant-geography*, the first and most important point is to determine a catalogue of the plants inhabiting definite areas, and the next to divide the areas into floral districts, based upon the relationship of the species and genera, and leading to a division of the areas into natural regions; following this there is the determination of the boundaries for species and genera, their distribution and relative numbers in various countries, the consideration of endemic forms, the relation of Insular Floras to those of the mainland, and of Mountain Floras to lowlands, etc., etc.

Œcological Plant-geography deals with quite another problem, it treats of the laws and influences affecting the forms and characteristic groupings of plants, and seeks to teach us how the external appearance and internal economy (*husholdning*) of plants and plant-communities (*plantesamfund*) are regulated according to the supply of warmth, light, nutriment, water, etc., which is at their command. A hasty glance suffices to show that species are not evenly distributed over the districts which compose their zone, but are grouped into companies with very varied physiognomy. The first problem suggested is to find out what species are confined to localities of a homogeneous character. The next, and very difficult one, is a solution of the questions: *Why* they are confined in distinct groups, and *why* these have their peculiarly distinctive features. This leads on to a consideration of questions relating to the internal economy of plants, their requirements according to the conditions under which they live, the manner in which they utilise the external conditions at their command, and adapt themselves to these in their structure and physiognomy, and especially to considerations of the "Forms of Life."

These are some of the complex questions to which Dr. Warming addresses himself. The scheme he adopts in his book is to divide it into sections: the *first* section treats of the factors which play a part in the internal economy of a plant and the influence these exert upon both the external and internal forms, upon the duration of life and other biological facts, as well as upon the topographical limitation of the species: the *second* treats of the arrangement into a system and the characteristics of the communities or "social classes" which are found upon the earth—*Hydrophytous*, *Xerophytous*, *Halophytous*, and *Mesophytous* vegetations; and the *third* of the struggle between the different communities. In the first section the various factors and their influences are considered in turn, although, as is pointed out, these

never operate singly, and it is often very difficult to assign to each its separate effect. They are conveniently divided into those whose action is *direct* and those in which it is *indirect*. The former include the *atmospheric factors*, viz., the composition of the air, light, warmth, rainfall and moisture of the air, movements of the air; and the *terrestrial factors*, viz., the character and composition of soils and their chemical and physical action. The indirect influences include the relief of the land, the configuration of the land and sea, the height above sea-level, the latitude as well as other controlling and modifying causes.

The author has brought to his task a store of very valuable material accumulated from his own observations, and he has consulted an immense amount of recent biological literature, but the incompleteness of our present knowledge naturally leaves room for future investigation, and the present work opens out an important field of inquiry which should give an impulse to others to work in the direction indicated.

M. C. P.

Fungus Flowers from Brazil.

Brasilische Pilzblumen. By Alfred Möller. 8vo. Pp. viii., 152. 8 plates. Jena: Gustav Fischer, 1895. Price 14 marks.

Möller's brilliant work on the fungus gardens of the leaf-cutting ants in Brazil, published in 1893, prepared us to regard with more than usual interest any further communication from him. His "Brasilische Pilzblumen," embodied in a recent number of the *Botanische Mittheilungen aus den Tropen*, while adding to our scientific knowledge, has largely enhanced his reputation. Our acquaintance with tropical, evanescent forms is apt to be very vague, dependent as it is on the chance gatherings and observations of passing travellers. Möller studied the fungus-flora of Brazil during three years with splendid success. He has confined himself in these papers to one family, that of the *Gasteromycetes*, which, especially the *Phalloideæ*, are much more abundant in tropical countries than in our temperate regions. He has added four genera and eight species to those already known, and has given us some very interesting details about the forms already familiar to us. He made large use of the photographic camera during the progress of his work, and its accuracy is, therefore, unquestionable. Indeed, a "lightning-sketcher" would almost have been necessary to make truthful drawings, so rapid was the growth and decay of some of the fungi. We have read with special interest the records of growth of the beautiful, though evil-smelling, tropical fungus, "the veiled lady," *Dictyophora phalloidea*. Möller was able to carry home specimens still in the "egg" condition, and to watch the bursting of the enveloping peridium with the marvellous elongation of the stalk. The average maximum of increase was two mm. per minute; but one specimen attained to five mm. during one minute. He states that not only could he see it grow, he could also hear it, the rapid extension of tissue causing a slight crackling sound. The "lady" expanded in the evening, the following morning her beautiful garment hung limp and soiled, and the rays of the morning sun completed the work of decay.

One of the most interesting and important of the fungi discovered by Möller, "*Protubera Maracujá*," belongs to the primitive group of the *Hymenogastreæ*. It has always been a task of great difficulty to understand the relation which the different members of the *Gasteromycetes* bear to each other. The development of "*Protubera*," so carefully worked out by Möller, proves it to be a tran-

sitional form between *Hysterangium* and *Clathrus*, thus confirming the view, held by some previous students of the group, that *Clathrus* and its allies had developed from the more primitive form. The other genera, *Blumenavia*, *Aporophallus*, and *Itajahya* belong to the highly-organised *Phalloideæ*. Möller has been led to dignify them with the title "Pilzblumen" (fungus flowers), on account of the striking odour, pleasant or otherwise, which they exhale, and also on account of the colours and forms displayed by the different species, which serve to attract insects, and so aid in the dissemination of the spores.

A. L. S.

LUNAR PHYSIOGRAPHY.

THE MOON: A full description and map of its principal physical Features. By Thomas Gwyn Elger. 8vo. Pp. viii-173, with 4 maps. London: Geo. Philip & Son. Price 5s. Map issued separately as whole sheet, 2s. 6d.

A CHEAP concise handbook to the moon has long been a desideratum, for no member of the solar system is more interesting, is more convenient of study or affords better training to the young astronomer than what the Irish ballad calls the "fine noble creature, which gives us the daylight all night in the dark." The works of Neison, Beer and Mädler, Schmidt, Nasmyth, etc., were either too expensive or somewhat out of date. A popular summary of the whole question of lunar physiography may, therefore, be expected to be of value to the increasingly numerous class of men who possess telescopes of sufficient power to aid in the work of mapping its surface. To these, Mr. Elger's book can be confidently recommended. It is concise, cheap, clear, and, as far as we have tested it, correct. It is conveniently arranged. It commences with a description of the different "earth-forms," which can be recognised on the moon, such as the great plains or "Maria," ridges, ring mountains, including craters, walled plains and crater pits, clefts or rills, and valleys. The exact significance of these different forms is discussed, and most of the principal theories are referred to. The two principal omissions which we notice in the literature is that there is no reference to the remarkable paper by Gilbert, and the still more recent one of Suess. The part of the work which discusses lunar geology is the least satisfactory, for the author's knowledge of the earth is not so well up to date as is that of the moon. This is unfortunate; for the impression is certainly growing that the explanation of lunar topography will come from the study of the geology of the great continental volcanic areas. It is useless, therefore, to quote men such as Professor Phillips, who wrote before the volcanic region of the Western States had been described. Mr. Elger, nevertheless, seriously discusses Phillips' comparison of the lunar ridges to kames and eskers, while his information on these is antiquated, for he says these are "of somewhat doubtful origin," and quotes one explanation of them to the effect that they are "old submarine banks formed by tidal currents like harbour bars." We should have been glad, moreover, if he had indicated the differences between the lunar rills and terrestrial cañons, and not simply dismissed the question by the remark that "the analogy, at first sight specious, utterly breaks down upon closer examination." We would venture to remind the author that cañons are not all due to the same cause as that which made the Grand Cañon of the Colorado.

The main part of the work is occupied by a catalogue of the lunar formations, those of the four quadrants being taken separately. Appendices give lists of the maria, mountains and ray systems, a table of lunar elements, and an alphabetical index to the formations.

The author is quite clear in his conviction that changes are taking place on the moon at the present time, and that exhalations are given off which temporarily obscure certain features. He therefore suggests the detailed study of limited areas, in order to check any such variations in structure or appearance. Some of the cases he quotes, of the disappearance and sometimes reappearance of certain features, are very striking, and certainly seem to prove that the moon is not a dead changeless world and burnt-out planet, as it is so often described.

J. W. G.

The Birds of Brazil.

As Aves Do Brazil, Primeira Parte. Por Emilio Augusto Goeldi, Dr. Ph.; Director do Museu Paraense Livraria Classica de Alves, Rio de Janeiro, 1894. Pp. 311.

This little volume is the first part of a work to be completed in two parts upon the birds of Brazil. The first part, now before us, contains introductory matter and an account of the raptores, psittaa, picariæ, and passeres. The method of classification adopted is plain and old-fashioned, with no attempts at modernity. The owls are grouped with the raptorial birds, the screamers are placed among "grallatorial" birds, between storks and ibises; while the natatores remain the strange assortment of web-footed creatures as in earliest attempts at classification. However, this detracts nothing from the value of the book, which simply is a straightforward guide to the birds of Brazil. It should prove useful to ornithologists, especially to those who have an opportunity of visiting that country, and its portable form will make it more serviceable than more detailed illustrated books.

Dr. Goeldi has prepared some interesting tables of the distribution of birds, showing the peculiar families, and the range of families that occur also in other regions. These, however, contain no novel matter, and, although we highly recommend this little book as a useful guide to its subject-matter, we cannot assign it any value as a contribution to science.

The June number of *Knowledge*, which has been sent us by the publishers, shows that this popular monthly continues to purvey for a large public interesting facts and theories of science "simply worded and exactly described." Special praise is due to the plates, of which the present number contains two, one an excellent reproduction of twenty-three Greek coins, the other showing photographs of two portions of the moon. The number contains an interesting article by Mr. Lydekker on the origin of the giant birds of South America.

Those connected with museums will be interested to hear of the establishment of a new journal, entitled *Revue Internationale des Archives, des Bibliothèques et des Musées*, published in Paris by H. Welter, 59 Rue Bonaparte, and issued in three separately paged sections, headed respectively "Archives," "Bibliothèques," and "Musées." The annual subscription is twenty francs.

OBITUARY.

VALENTINE BALL, C.B., LL.D., F.R.S.

BORN JULY 14, 1843. DIED JUNE 15, 1895.

THE untimely death of the Director of the Science and Art Museum, Dublin, removes one of the leading men of science of that city. Born in Dublin, the second son of Dr. Robert Ball an enthusiastic naturalist and superintendent of the University Museum, and the younger brother of Robert Ball, now the well-known astronomer, Valentine Ball was brought up amid surroundings well calculated to foster a love of Nature. He was educated at Chester, Rathmines, and Trinity College, Dublin, holding during his university course a clerkship in the Chancery Office. In 1864 he resigned this post to take up far more congenial work on the staff of the Geological Survey of India. During his service in the East, he paid special attention to the economic aspects of his science, and enriched the memoirs of the Survey by many valuable papers on the building-stones, coal-fields, minerals, gold-bearing rocks, and gems of the country. The main results of his labours in this field will be found in the "Manual of the Geology of India, Part III., Economic Geology," 1881. His geological work, however, by no means absorbed his whole attention; he took advantage of the opportunities offered by his journeys to study the plant and bird-life of the country, and to accumulate notes on the less-known native races of men; such observations were summarised in his "Jungle Life in India."

In 1881, Ball returned to Dublin to succeed Rev. S. Haughton, as Professor of Geology and Mineralogy in the University. He held the chair for only two years, being appointed, on the death of Dr. Steele, in 1883, Director of the Science and Art Museum. During the ensuing twelve years he laboured unremittingly for the development of the institution over which he was placed. Museum administration was highly congenial to his tastes, and he threw himself into the work with the greatest enthusiasm. The Dublin Museum has grown largely under his rule, and the story of its progress was given to readers of NATURAL SCIENCE, in July last year, in his presidential address to the Museums Association, where the accumulation of the various collections, the erection and opening of the new building for the art division, and other recent developments were described at length. To the geological and mineralogical specimens under his care, he naturally devoted special attention. In 1884, Ball attended the Montreal meeting of the British Association, and took

advantage of the occasion to visit the principal museums of Canada and the States, and to embody his observations in a valuable report. When, three years ago, failing health warned him to take a few months' rest, he chose to visit Egypt, a country which can hardly be said to furnish a thorough change to a museum officer; while only last year he made a tour of the museums of Scandinavia, Germany, and Austria, a report on which was engaging his attention at the time of his death. For several years past he held the post of Secretary to the Royal Zoological Society of Ireland, and took a leading part in the management of the gardens in Phœnix Park. His leisure studies turned towards the border-land between science and literature. His interest in the relations of the Greeks with the East led to a paper in 1885 "On the Identification of the Animals and Plants of India, which were known to early Greek Authors." The histories of famous gold-nuggets, diamonds, and inscribed rubies, also had much attraction for him, and he edited a new edition of Tavernier's "Travels." His was a nature to be ever active, and it is to be feared that the wear and worry of his responsible post with its delicate relations with various institutions, his desire to supervise personally all possible details of administration, and his resolve to work with his might while the day for work was still his, contributed to materially shorten his life. He was at his office but a short week before he passed away, and though mourning his removal while still in his prime, his colleagues and friends feel that he leaves them the example and inspiration of unflagging devotion to duty. G. H. C.

WILLIAM CRAWFORD WILLIAMSON.

BORN NOVEMBER 24, 1816. DIED JUNE 23, 1895.

ON June 23 there passed away one whose name will always hold a prominent position in the records of botanical science. William Crawford Williamson was born at Scarborough, on November 24, 1816; he received his early education partly in his native town and, to some extent, in a French school.[1] From 1832 to 1835 he made his first acquaintance with medicine in the house of Mr. Thomas Weddell, a Scarborough surgeon, and in the latter year was appointed Curator of the Museum of the Manchester Natural History Society. After qualifying as a member and licentiate of the College of Surgeons in 1840, he became a medical practitioner, and remained for many years an active member of the profession. In 1851, Williamson was appointed Professor of Natural History and Geology at Owen's College; he resigned the chair of Geology in 1872, that of Zoology in 1879, and that of Botany in 1892, when he was made Emeritus Professor. Elected a Fellow of the Royal Society in 1854, he was

[1] The facts of Professor Willamson's early life are taken from an admirable memoir, by C. Bailey, published in the *Manchester Scientific Student's Annual Report* for 1886.

awarded the Royal medal twenty years later; in 1883 the University of Edinburgh conferred upon him the degree of LL.D. In recognition of his ability as a scientific worker he was enrolled an honorary member of several foreign and English societies. Inspired at an early age with a true natural history spirit, Williamson was led by his energy and love of work to publish several papers on widely different branches of natural science. In addition to his contributions at this early period to scientific literature, it should be noted that many of the illustrations of Yorkshire Mesozoic plants in Lindley and Hutton's classic work were drawn by the same hand which in more recent years has enriched the pages of the Royal Society's *Transactions*. During his residence in Manchester as a medical practitioner, Williamson found time for several contributions to different societies on palæontological subjects. At a meeting of the British Association, in 1842, he read a paper on the "Origin of Coal," and from this preliminary note we may date the beginning of his untiring devotion to the microscopical examination of the structure of coal and the tissues of Carboniferous plants. From time to time, at subsequent British Association meetings, short notes have been given, showing the steady progress of his immense undertaking to investigate the minute structure of the coals of the world, and this work was continued up to a short time before his death, when he generously handed over the work of many years to be completed by a younger worker. Most conspicuous among Williamson's work prior to 1860, are his valuable contributions to the History of the Foraminifera. It was, indeed, in this branch of Natural History that Williamson first established a reputation as an original investigator. In later years his energies were centred in palæobotanical researches, and in this chosen field of work he achieved a splendid success. The examination of fossil plants, originally confined to the description and uncertain determination of structureless specimens, was raised to the level of an accurate study by the use of the microscope, inaugurated by Witham, Corda, and others, and followed up by Binney, Carruthers and Williamson. It is not too much to say that the labours of the latter author deserve to be spoken of as marking a new era in palæobotanical science. Among Williamson's earlier papers, mention should be made of a detailed and exceedingly able memoir on the well-known Jurassic fossils for which Carruthers instituted the generic name of *Williamsonia;* since this paper was read before the Linnean Society, in 1868, various attempts have been made to settle the botanical nature of this problematical genus, and recent work tends to a large extent to confirm Williamson's conclusions. Passing over other palæobotanical contributions we must, finally, refer to the invaluable series of memoirs "On the Organisation of the Fossil Plants of the Coal-Measures," begun in 1871 and completed in 1893. It is impossible to give any adequate expression of the importance of these memoirs in a short obituary notice. The labour and scientific skill embodied in this legacy to botanical science

have only been at all fully realised in recent years. Hampered by a strong prejudice in favour of a certain classification of Palæozoic plants, established by Adolphe Brongniart, and cramped by a conception of botanical morphology founded solely on recent plants, botanists were slow to accept Williamson's startling conclusions, and it was only by the gradual accumulation of convincing evidence that his results gained general acceptance. There is no longer any serious attempt to deny the existence in the Coal-Measure forests of various arborescent vascular cryptogams, which in their fructification agreed in all essential respects with recent members of the same class, but in their manner of secondary growth in thickness showed the closest agreement with gymnospermous or dicotyledonous trees. Last year there appeared the first of a new series of memoirs under the joint authorship of Professor Williamson and Dr. D. H. Scott; the wealth of material dealt with, and the extraordinary completeness of the detailed description of such plants as *Calamites* and *Sphenophyllum*, afford some indication of the value of that class of work of which Williamson was to a large extent the founder. In addition to the Royal Society memoirs, reference must be made to the masterly monograph on *Stigmaria ficoides*, contributed to the Palæontographical Society in 1886. In the *Proceedings* of the Manchester Literary and Philosophical Society there are numerous papers on fossil plants by Professor Williamson, and the last of his botanical contributions is an exhaustive and elaborate account of certain points in the growth and development of Carboniferous Lepidodendra, communicated in October, 1894, to the society of which he was president for more than thirty years.

Those who were privileged to know Williamson, not only as a botanist, but as a personal friend, will always think of him as a striking personality, in which the enthusiasm of the real student was combined with a generous and open-hearted spirit. Emphatic in his expression of opinion, and at times carried away by the strength of his own convictions, Williamson would occasionally be led to enunciate a general truth in somewhat too sweeping terms. It was this strength of conviction, a steady determination of purpose, and an eager longing to solve difficult problems which enabled him to achieve so much towards the advancement of botanical science. Not only was he a thorough and cautious student in special branches of science, but at the same time a keen naturalist, and eminently successful as a popular exponent of botany and geology. To attempt to form any just estimate of the value of Williamson's life-work, or to call up, however imperfectly, the most striking traits in his character, is a difficult task for one who, like the present writer, is under a very strong obligation to the never-wavering kindness and true friendship of the most affectionate and generous of teachers. His reputation as a man of science may be safely left to the judgment of Continental colleagues, and to future generations of palæobotanical students.

A. C. S.

DR. E. C. DE CRESPIGNY, born in 1821 at Vevey, Switzerland, died at his home at Beckenham, Kent, on February 15 last. Though of foreign birth, his education was chiefly English, and in 1845 he entered the Indian Medical Service. In 1859 he became Acting Conservator of Forests and Superintendent of the Government Botanical Gardens at Dapoorie, near Poonah; but, owing to illness, was obliged to return to England in 1862, where he made his home at Beckenham. The remainder of his life was devoted to the study of botany, and the formation of a herbarium. In 1877 he published a small volume entitled "A New London Flora." A small collection of coloured drawings of plants, made during his residence in India, is in the Botanical Department of the British Museum.

MR. E. J. GLAVE, who died on May 12 at Underhill on the Congo, had served under Stanley during the organisation of the Congo State. He visited Lake Nyassa and Karanga in 1893, and made some interesting notes on the burial place of Livingstone. Mr. Glave was an accurate observer, and his skill as a draughtsman gave additional value to the contributions, only too few in number, that he added to the literature of the Congo basin. He did brilliant work for the Free State, and his early death will be deeply regretted by all whom he met in Africa, and who will long remember his bright humour and unvarying good temper.

OWING to the pressure on our space last month we were quite unable to chronicle the deaths of Dr. FRANCESCO SANSONI, the eminent mineralogist of the University of Pavia; Dr. JULES CROISSANDEAU, well known for his work on Coleoptera, of Orleans; Dr. JOHN ANTHONY, the microscopist, who died at Birmingham on June 3; Dr. F. E. NEUMANN, the physicist, who passed away at Königsberg on May 23, at the age of 97; Dr. JOHN BYRON, the eminent bacteriologist of the Loomis Laboratory, in May; Dr. F. MÜLLER, of Basle, the herpetologist, whose catalogues of the Reptilia and Amphibia of the Basle Museum form valuable books of reference; SIR SAMUEL WILSON, a Royal Commissioner for the Fisheries Exhibition, who died early in June; A. W. SCHERFEL, the founder of the Tatra Museum at Felka, who died on April 24; Professor Dr. W. Voss, the mycologist of Vienna, who died at that city on March 30; R. P. BON, well known as a botanical collector in Tonking and Annam. Dr. GIDEON MOORE, the mineralogical chemist of New York, died on April 13, aged 53 years; Dr. H. F. C. CLEGHORN, formerly of the Forest Department of India, and for long president of the Royal Scottish Arboricultural Society, in May; H. N. SANDBACH, the ornithologist of Denbigh, early in June; JOHN H. REDFIELD, botanist and specialist on vascular cryptogams, on February 28, at Philadelphia, in his 80th year; and PIETRO DODERLEIN, Professor of zoology and geology, in Palermo, on March 28, aged 84.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

THE following appointments have recently been made:—Dr. T. Smith, as Professor of Applied Zoology at Harvard University; Deputy Surgeon-General Billings, of the "Catalogue of the Surgeons' General Library," to the chair of Hygiene in the University of Pennsylvania; W. G. Ellis, as Demonstrator of Botany in the University of Cambridge; Dr. T. G. Brodie, as Lecturer on Physiology at St. Thomas's Hospital, London, in succession to Professor Sherrington; Charles D. Aldright, to be Instructor in Biology in the University of Cincinnati, U.S.A.; Charles Leigh, Attendant in the Library at the British Museum (Nat. Hist.), to be Assistant Secretary and Librarian to the Manchester Literary and Philosophical Society. Dr. E. Hering, of Prague, succeeds Carl Ludwig as Professor of Physiology at Leipzig. Dr. Hans Schinz takes rank as Ordinary Professor of Botany at Zürich. Professor W. Peterson, of Dundee, is elected Principal of McGill University, in the room of Sir J. W. Dawson. Dr. E. C. Quereau becomes Professor of Geology and Mineralogy in Syracuse University, U.S. Dr. T. T. Groom succeeds the late Allen Harker as Professor of Natural History at the Royal Agricultural College, Cirencester, and Mr. S. S. Buckman will now be relieved of the temporary duties he undertook at Mr. Harker's death.

DR. A. KOWALEWSKY has been elected by the Paris Academy a corresponding member (zoology), in place of G. H. Cotteau. Sir Archibald Geikie has been elected a corresponding member of the Royal Academy of Science in Vienna. Dr. A. R. C. Selwyn has been elected President of the Royal Society of Canada for the session 1895–96. Professor T. T. Groom, of Cirencester, has received the degree of Doctor of Science, *honoris causa*, from the University of London. Mr. J. S. Gardiner, of Caius College, Cambridge, will occupy the University Table at the Naples Zoological Station from October, 1895, to March, 1896. Mr. A. W. Rogers, of Christ's College, Cambridge, has been awarded the Harkness Scholarship in Geology. Mr. Walter E. Collinge has been awarded the Darwin Medal by the Midland Union of Naturalists for his researches on the cranial nerves and sensory canal-system of fishes. Dr. Roux has received a gold medal, specially struck for the occasion, from the Paris Municipal Council for his discovery of anti-diphtheritic serum.

JOHNS HOPKINS UNIVERSITY has founded a Geological Lectureship in memory of Professor G. H. Williams. There will be a short course each year, and men eminent in their science will be asked to deliver each series. The first offer has been made, we understand, to Sir Archibald Geikie. This, besides being complimentary to foreign geologists, will be of considerable advantage to American students, for they will thus obtain new and different views of the subject, and will find an increased interest in languages other than their own.

PROFESSOR LLOYD MORGAN will deliver a series of four lectures on the Habits and Instincts of Birds, before the Biological Class of Columbia University next winter.

MEMORIALS to Professor Huxley are mooted. Since he received his early scientific and the whole of his medical education at the Charing Cross Hospital

Medical School, those connected with that hospital have resolved to establish a memorial that "shall take the form of a Huxley Scholarship and Medal, to be awarded annually at Charing Cross Hospital Medical School, and that if funds permit an annual lecture at the Charing Cross Hospital Medical School, dealing with recent advances in science and their bearing upon medicine, shall be instituted." Subscriptions may be sent to Dr. Watt-Black. It has further been proposed to erect a national memorial, possibly in the form of a statue in the Natural History Museum, Cromwell Road.

AMONG the liberal sums so generously given to American institutions we note that of an unknown donor, whose name is never to be revealed, of 250,000 dollars, for the purpose of founding a library, museum, and hall for the University of the City of New York. Mr. C. C. Harrison has given 100,000 dollars to the University of Pennsylvania. The income from the fund, which is in memory of Dr. G. L. Harrison, is to be used for the "Encouragement of Liberal Studies and the Advancement of Knowledge." We learn from the *Daily Chronicle* that the 250,000 dols. subscribed for a proposed Botanic Garden in New York was really subscribed by twenty-two people, and not by two millionaires, as previously reported. It now remains for the City of New York to raise 500,000 dols. by bonds for building purposes, etc., and to present 250 acres of land in Bronx Park. The same newspaper records an offer from six men to build a Hall of Science for Syracuse University at a cost of 150,000 dols., while 110,000 dols. have been offered towards a new medical college.

A SUPPLEMENTARY Charter has been granted to Durham University, and enables Convocation to grant to women any degrees, excepting only degrees in Divinity, which they have the power to grant to men. The degrees of the University of Durham in Medicine, Science, Arts, Literature, and Music are, therefore, now obtainable by women. The Medical and Science Faculties are in Newcastle-upon-Tyne, the former in the College of Medicine and the latter in the College of Science, where women students can receive instruction in the various subjects of these two faculties. The first woman graduate—Miss Ella Bryant—received her degree of Bachelor of Science at the meeting of Convocation, held on June 24.

THE *Twenty-ninth Annual Report of the Museums and Lecture Rooms Syndicate* of Cambridge University has just been issued. The Syndics draw attention to the want of co-operation between those responsible for old buildings and those engaged on erecting new ones, which has caused much inconvenience that could easily have been avoided.

An important change has been made in the arrangement of the Herbarium. Like so many natural history collections in our larger museums this was formerly subject in some degree to a topographical arrangement; the existence of two collections—European and general—frequently necessitated search in two places for any plant; these two collections have now been united, and the geographical arrangement and coloured labels in use at Kew have been introduced. We commend a similar consolidation to all curators in charge of extensive collections. The Samoan and Fijian plants presented to the Herbarium by Baron v. Hügel have been determined by Mr. Burkitt, who is now engaged on those from New Britain. The arrangement of the algæ and mosses is also progressing. Among the chief donations are mentioned Bornean plants from Mr. G. D. Haviland, Indian plants from the Government of Bengal, and Lapland mosses from Professor Elfving. We are glad to see that some work is being done in this Herbarium, and hope it is a sign that the Universities are taking greater interest in systematic botany.

Among the important additions reported as made to the Museum of Zoology are deep-sea Crustacea, presented by Dr. A. Alcock, the White Rhinoceros, to which we alluded in vol. iv., p. 324, a skull of the Elephant Seal, obtained through Professor Jeffery Parker, of Dunedin, N.Z., and several valuable specimens from North-east Borneo, sent by C. and E. Hose. To the Termites, presented by Mr. G. D. Haviland,

which constitute a most important collection, we have already referred (vol. iv., p. 407). Dr. Sharp says that this collection has not been incorporated in the Museum as yet, but remains at the disposal of anyone able and willing to work it out. Dr. Gadow's appeal for bird-embryos has been liberally answered by Walter Heape.

The Geological Museum has received fresh additions to the collections previously presented by Professor Wiltshire, including many type-specimens. The Rev. G. F. Whidborne has presented figured specimens of seventy-two species of Devonian fossils. Some fine limb-bones and teeth of *Elephas meridionalis*, *E. primigenius*, and *Bison* sp., dredged off Yarmouth, have been purchased. The work of arrangement, of cataloguing, and of teaching, continues, though under great difficulties owing to want of space. The erection of the new Museum, of which the plans were published in NATURAL SCIENCE for December, 1893, is still deferred, and the heart of Professor Hughes is sick.

IN our April number (p. 232, vol. vi.) we referred to the addition to the Education Code, which permits the visits of board-school children to museums to be counted unto them for "attendance." On Tuesday, June 25, a meeting of board-school teachers was held at the Whitechapel Museum, 77, High Street, Whitechapel, to consider how advantage might best be taken of this beneficent addition to the code. Mr. G. L. Bruce, Member of the London School Board, took the chair, and Miss C. A. Raisin delivered an address in which she pointed out the good to be gained by those teachers who would avail themselves of this permission, and who would properly prepare themselves for each visit. She laid stress on the habits of order and observation that might be inculcated, deprecated an excessive use of note-books, and suggested the formation, by the children themselves, of small collections in each school. In the discussion that followed, there seemed to be a fear (surely groundless) that difficulties would be raised by the Inspectors, whose permission has in each case to be gained; one speaker was doubtful whether a visit to the British Museum would receive official sanction. Some teachers shrunk from the fresh burden laid on them, and complained of the length of time that would be required for such a visit, though it could ill be spared. On the whole, however, the feeling was that, if only the suggestion could be put into practice, it would prove valuable. Mr. F. A. Bather, in proposing a vote of thanks to Miss Raisin, reminded the teachers that they were the interpreters between the curators and the children, and explained some of the aims of the modern curators. He advocated short and cheerful visits with a definite object, the study and explanation of familiar things, and a constant remembrance that the museum was only a makeshift epitome of the whole actual world of nature, industry, and art. While recognising the value of the collector's enthusiasm, he would not waste this in small local channels, but rather have such a museum as the Whitechapel Museum working in unison, as an educational factor, with all the schools in its neighbourhood.

We cannot too strongly impress upon teachers the importance of preparing for the museum visit, and not waiting for the inspiration of the moment. Miss Hall, the curator at the Whitechapel Museum, is in attendance from 3 p.m. to 9 p.m. on Tuesdays and Thursdays, and from 10 a.m. to 4 p.m. on Wednesdays and Saturdays; during these hours she will talk over with the teachers the subject for the next museum visit. The teachers in this district have also the use of an excellent Reference Library—the Museum in question being in connection with the Free Public Library. During the winter, the monthly lectures will be resumed, and a series of demonstrations will be arranged expressly for teachers.

A NEW room, furnished by special subscriptions from some members of the Chester Society of Natural Science, has been opened at the Grosvenor Museum, Chester, and in it the local collections have been arranged. A few features in the collection call for comment. The fossil and recent mammals are arranged together, the former being elucidated by photographs of the restored animals. The general and local distribution of the birds are shown by maps and by printed extracts from W. H. Dobie's paper, "Birds of West Cheshire, &c.," published in the *Proceedings* of the

Society, 1894. The life-histories of the various species continue to receive additions, and twenty-seven specimens are now illustrated. The mounting of the reptiles and amphibians is specially to be commended. Attractiveness is lent to the Bryozoa by photographs of the living animals taken by Dr. Stolterfoth. This museum is already celebrated for its exhibits of life-histories of insects, and Mr. Newstead continues his valuable work in this direction. A fine collection of the recent and fossil Foraminifera of the district, illustrated by drawings and models, has been arranged and presented by J. D. Siddall.

WE are pleased to note that Mr. Edward Wilson's admirable little "Guide Book to the Bristol Museum" has already reached a fifth edition. The museum is now open to the public late every evening, except Friday, and is rapidly growing in popularity. So many elementary students make use of the collection of rocks and fossils, that the Curator has now arranged a special cabinet of specimens best suited to their purpose. They can handle these without fear of damage, and the valuable type-specimens in the exhibited collection are thus preserved from all risk at inexperienced hands.

AN important addition has recently been made to the Liverpool Museum. A room long used for the storing of lumber has been transformed into a handsome gallery for the display of the valuable ethnographical collections. At the opening ceremony, on June 19, addresses were delivered by Sir William Forwood, Mr. W. H. Picton, the Lord Mayor, and Dr. H. O. Forbes, the Director of Museums. We give a few extracts from Dr. Forbes' speech, as reported in the *Liverpool Daily Post*.—"The earliest foundation of the purely ethnographical collection was laid by the purchase made by the Corporation as long ago as 1857, of the large and valuable collection of Captain Savage. The munificent gift of Mr. Mayer ten years later, not of a gallery only, but of a full-fledged museum (with which the Savage collection was incorporated), not only added largely to the special department of ethnography, but, by bringing the museum into a still more prominent place than previously among provincial institutions, was the means of attracting to it further valuable donations. An ethnographical loan exhibition held in Liverpool in 1880, contributed to by possessors of collections all over the country, was instrumental in still further increasing its treasures. At the dispersal of that loan exhibition, the Corporation's collection was exhibited for a short time in a temporary building, but the extension of the art gallery absorbing the ground on which it stood, the greater part of the collection had to be stored away. It was, nevertheless, being constantly augmented by donation and purchase. Among various benefactors to this department, I may perhaps mention specially the late Lord Derby and Sir Augustus Franks of the British Museum, both of them great benefactors to the gallery, as also Mr. G. B. Medley, the late Mr. J. G. C. Harrison, Mr. Clements Markham, C.B., Captain Stubbs, R.N., Consul Harper-Parker, Mr. R. D. Radcliffe, Captain Sibthorpe, and Mr. P. H. Rathbone, whose name occurs on many pages of the catalogue. The collection can never be mentioned, however, without recalling the gift by Mr. John and Mr. Ernest Tinne, of the important collections made by that distinguished traveller, their intrepid relative, Miss Alexandrine Tinne, who devoted her fortune and finally lost her life in the cause of science. Thirty years ago African exploration was a very different and far more hazardous matter than it is to-day. For an unprotected lady to have penetrated, as Miss Tinne did, far towards the source of the White Nile, against difficulties, dangers, and disasters, required an unfainting heart and indomitable pluck not always found even in powerful men, and hers has never been excelled in any male explorer. Liverpool claims the honour of her birthplace, and the collections of this remarkable woman will always have an honourable place in its museum. Besides donations and purchases, this collection owes not a little to the generous loans of several owners. The most valuable and important are those of the late Mr. A. P. Bell, lent by his family, and more especially the extensive collection deposited by the council of the Royal Institution, which contains numerous pieces which it is now impossible ever to obtain. . . . . The Derby and

Mayer Museums appear to many, I fear, to contain collections with little or no relationship with each other, the one being biological and the other devoted to antiquities, pottery, and other works of art. If the buildings in which these museums are housed were so constructed as to enable the biological collections to be arranged in scientific order—that is in the sequence of the origin and development—an arrangement which, I trust, may be possible at no very distant date with the intended extension of these buildings—then this ethnological gallery would follow naturally and immediately after that devoted to the history of the anthropoid animals. . . . In the anthropological gallery devoted to the history of the highest family of the anthropoids, man, we attempt to display his osteology, embryology, his geographical distribution, and the effects of climate and surroundings in producing different races—in other words, his biological history. Then in this gallery we follow his intellectual history, tracing its rise and progress through the barbarous or less civilised peoples, following his culture and achievements in the adjoining galleries of the Mayer Museum. The collections in this gallery are arranged geographically, commencing in the near room with the earliest traces of man; then follows the ethnography of the peoples of Siberia, Greenland, and Labrador, the Esquimaux, and Samoyeds; then that of the Indians of the American continent from Canada to Patagonia; in the further room we traverse the Eastern Hemisphere and study the ethnography of the black peoples or Melanesians of Africa, Australia, Papua, New Hebrides, and Fiji; then of the Polynesians of Samoa, New Zealand, and the Pacific; next the Mongolians of Malaya, China, and Japan; and finally that of the Indian Peninsula and Burmah."

This museum has recently acquired the ornithological collection of Canon Tristram. It contains some 30,000 specimens, and is rich in the birds of oceanic islands.

An important series of Purbeck and other fossils is now being added to the exhibited collection in the Dorset County Museum, Dorchester. The new acquisition is the gift of the Trustees of the Corfe Castle Museum, which was closed last year. The fossil fishes from the Dorset Purbecks are especially fine in the County Museum, and several of them were described by the late Sir Philip Egerton in the *Decades of the Geological Survey*.

The Museum of the Whitby Literary and Philosophical Society, of which Mr. Newbitt is now curator, has been thoroughly cleaned and re-arranged, and proves very attractive to the numerous visitors who frequent that watering-place during the season. All the local zoological specimens and fossils have been placed in the large central room, and the beautiful collection of moths is already in good order. The case of Arctic specimens obtained by the celebrated William Scoresby, a native of Whitby, is also noteworthy; and there are some mementoes of Captain Cook, who served his apprenticeship in the town. The museum of the once-famed Scarborough Society appears in a much-neglected state compared with that of its neighbour further north. Some of the larger fossils are falling to pieces, and it is to be hoped that recent changes in management will tend to restore the reputation the institution once held. Our lamented friend, Professor W. C. Williamson, was the last of the small but eminent band of naturalists who formed and preserved the collection in the early decades of the century.

We have received from Dr. E. A. Goeldi numerous pamphlets relative to the Para Museum. One of these, "Practical Instructions for the Collection of Natural Objects," printed in Portuguese, should prove of considerable assistance to South American Naturalists. It contains, among other things, a reproduction of Natterer's plate of *Lepidosiren paradoxa*, of which animal many examples have recently been received in England. These instructions are also appearing in *Boletim do Museu Paraense*, a new publication of which the second part has just reached us. This part contains a plate of the young and eggs of the famous *Opisthocomus cristatus*.

The editors ask for an exchange of publications, and particularly desire papers relating to South America. Address 399, Caixa do Correio, Para, Brazil.

THE collection of European Lepidoptera formed by Th. Goossens has been presented by his widow to the Museum of the Association des Naturalistes de Levallois-Perret. We also learn from the *Feuille des Jeunes Naturalistes* that the Society has moved to more commodious premises in the Rue Lannois.

IN his address before the Geological Society last February, recently received, Dr. Henry Woodward referred to the fact that thirty-five years ago Leonard Horner, as President of the Society, with the concurrence of Sir Charles Lyell, Sir Roderick Murchison, and other members of Council, decided to arrange for the admittance of ladies to the evening meetings of the Society. It is believed that the Misses Horner attended those meetings, which, by the way, were held at the apartments of the Royal Society; but the attempt was soon abandoned as a failure.

THE sixty-fifth meeting of the British Association will be held at Ipswich on September 11, under the presidency of Sir Douglas Galton. Professor Meldola will preside over the Chemical Section; Mr. Whitaker over the Geological; Professor Herdman over the Zoological; Mr. H. J. Mackinder over the Geographical; Professor Flinders Petrie over the Anthropological; and Mr. Dyer over the Botanical Section. The Physiological Section will not meet; papers on the subject will, however, be read in the Zoological Section.

The Association visited Ipswich in 1851. The town possesses a fine museum, celebrated more especially for its geological collections (crag). Geological excursions to the Crag districts and the Cromer cliffs are being organised, and marine dredging excursions will be made down the Orwell from Ipswich to Harwich. Excursions of general interest will be arranged to Bury St. Edmunds, Colchester, the Broads, Cambridge, Brandon, Dunwich, Wenham, and other places.

THE third International Congress of Physiology will be held at Berne, September 9–13. Those interested should write to Professor Kronecker, of Berne. The subscription is fixed at 10 francs.

AT an International Conference on the Protection of Wild Birds, held in Paris the last week in June, under the Presidency of M. Gadaud, Minister of Agriculture, a convention was adopted providing for the preservation of species useful to agriculture throughout Europe. England was represented by Sir Herbert Maxwell, Bart., M.P., Mr. Howard Saunders, and Mr. Harford of the British Embassy. The countries which sent delegates besides France were Germany, Russia, Austro-Hungary, Belgium, Holland, Luxemburg, Switzerland, Monaco, Italy, Greece, and Spain.

THE International Geographical Congress promises to be a success, if one may judge from the names of intending visitors. We shall give some account of it in our next number.

THE Galway Conference of the Irish Field-Club Union on July 11-17, to which we briefly referred in our last number, proved a great success. An excellent circular, with reproductions of some of Welch's and Dixon's photographs, was issued to the members. A full and illustrated account will be published in the *Irish Naturalist* for September.

THE beautiful wooden statue of the double of the Egyptian king Ra-Fou-Ab, found by the De Morgan exploration party in one of the pyramids of Dahshur, has been reproduced in *Nature* (June 6) from *Le Monde Moderne*. The statue is believed

to date from the 12th dynasty. With it are given illustrations of the exquisite goldsmiths' work of the period, one of which bears the cartouch of Usertesen II., another that of Amen-em-hat III, and a third that of Usertesen III.

PROFESSOR CANAVARI'S scheme for a *Paleontografia Italiana* has met with so much success that the first volume will be issued about the end of the year. It will be a quarto, with twenty plates, and will be published at Pisa, price fifty francs. Materials for a second volume are already in hand, and should the first be a financial success, the second will immediately follow.

WE learn from the *Scottish Geographical Magazine* that Dr. O. Nordenskiöld and Dr. Ohlin will shortly proceed to Tierra del Fuego to explore the country. They will remain there till the summer of 1896. Dr. F. A. Cook will start from New York, on September 1, on an Antarctic Expedition. He will take two small vessels, provisioned for three years, and hopes to reach Erebus and Terror Gulf about the beginning of December. Professor W. H. Dall and Dr. G. Becker, on behalf of the United States Geological Survey, are conducting a natural history expedition to Alaska.

A REUTER'S telegram says that the steamer "Kite" left St. John's on July 9 for Bowdoin Bay, Greenland, to bring home the Peary Arctic Expedition. It is expected to return on October 1. The party on board includes Professor Salisbury, of Chicago, who goes to study the glaciers and geology of the region, and Professor Dyche, of the State University, Kansas, to collect specimens of the fauna and flora, while Mr. Boutillier, of Philadelphia, represents the Geographical Society. Lieut. Peary will probably bring home a great meteoric stone which was found near Cape York.

SEVERAL cases of specimens have reached the British Museum (Nat. Hist.) from Dr. Forsyth Major in Madagascar. The greater part of the collection comes from the forest and the neighbourhood of Ambositra, and consists of zoological specimens, including a very important consignment of skins of mammals, several of which are believed to be new to science, a very fine series of dried plants, and a valuable assortment of ethnological objects from the Betsileo country, among them being many articles of singular interest illustrating the domestic life of the tribe inhabiting this little known part of Madagascar. If all be well Dr. Forsyth Major should now be fairly at work excavating in the marshes of Sirabé for Pleistocene vertebrate remains, the discovery of which was the primary purpose of the expedition.

COAL in the Sahara has been reported to the Paris Academy of Sciences by M. Foureau. The field occupies an area contained between lat. 27° and 28° N. and 5° and 6° 30′ E., and has been traced at nine points within the area. *Lepidodendron* has been noted, as well as crinoids and *Producti*.

IN our issue for October, 1894, we quoted a paragraph from the *Pittsburgh Despatch* on adaptation of cats to cold, which stated that the cold increased the thickness of the fur, and the dim light of the storage warehouses tended to lengthen the "feelers." A letter from the Secretary of the Storage Company, published in the *American Naturalist* for June, shows that the facts have been exaggerated, and that the "adaptation" is comparable with that which takes place in warm climates on the approach of wintry conditions.

CORRESPONDENCE.

A Plague for Locusts.

In the spring of this year the coast lands of South Africa were visited by swarms of locusts—fortunately a rare occurrence in these localities; for though the country further inland had often suffered from their depredations, the regions on or near the coast have been mostly spared. There had not, indeed, been such a plague for some thirty years.

Mr. Maurice Evans, of Durban, an enthusiastic naturalist, heard that on a certain sugar estate the locusts were dying in large numbers, and he went up to investigate, and, if possible, encourage the disease. Nature seemed in this case to join with man in his efforts to reduce the numbers of the invading host. "The disease," he reported, "was having very marked effects. There were hundreds of acres of sugar-cane with dead locusts hanging on every leaf, in one case so thickly as to give a grey appearance to the otherwise green cane. They always appear, when dying," he adds, "to cling tenaciously to some object, so that after death it is somewhat difficult to detach them."

Mr. Evans found that the locusts were attacked by a fungus, and he sent to the British Museum several specimens preserved in spirit, that its true character might be investigated. As he had surmised, the fungus proved, on examination, to be an *Entomophthora*, nearly allied to that which attacks house-flies.

The first record of its appearance is in the *Botanische Zeitung*, 1856, p. 882. Fresenius gives there an account of some grasshoppers that had been sent to him which had died from the attacks of a fungus. He described it, and named it *Entomophthora gryllii*. The disease has also been met with on locusts, and there is no doubt that here, in South Africa, we are dealing with the same organism.

The entire body-cavity of the locusts sent by Mr. Evans was filled by the coarse granular mycelium of the *Entomophthora*—a confused tangle of rather dark-coloured hyphæ, with characteristic large oil-drops. Between the segments the filaments had protruded and budded off spores, large pear-shaped bodies that were germinating irregularly *in situ*, and producing again the gross-looking mycelium. Similar little clumps of hyphæ and spores occurred on the face of the insect. The resting-spores of this species have not been recorded, and were not to be found on the specimens sent by Mr. Evans.

It is to be hoped that the disease may have effectually diminished the swarms of the unwelcome visitors; it is hardly likely that the fungus will die out. We cannot say that the ranks of our house-flies have been much thinned by the ravages of the constantly-recurring *Empusa muscae*; but evidently the epidemic among locusts is of a more virulent nature, and for the sake of agriculturists at the Cape we can only wish that it may spread still further.

Annie Lorrain Smith.

NOTICE.

To Contributors.—*All communications to be addressed to the* Editor *of* Natural Science, *at* 22, St. Andrew Street, Holborn Circus, London, E.C. *Correspondence and notes intended for any particular month should be sent in not later than the* 10*th of the preceding month.*

To the Trade.—Natural Science *is published on the* 25*th of each month; all advertisements should be in the Publisher's hands not later than the* 20*th.*